

Student Learning Styles in Solving Math Story Problems on the Material of Two-Variable Linear Equation Systems

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Abstract

Students' information gathering is heavily reliant on their learning styles. Mathematical education calls for a deeper examination of methodological variations. This study examines the correlation between students' learning styles and their ability to solve math word problems involving a system of two-variable linear equations. The method employed is a qualitative, descriptive research method. The instruments utilized are student aptitude and learning style assessments. Data analysis methods include data collection, data reduction, and data interpretation. The findings included that the visual and auditory subjects completed only three of the five questions they deemed simple. Comparatively, kinesthetic subjects were able to answer four questions. When reexamining the visual, auditory, and kinesthetic subjects, the obtained answers are not rechecked. By concluding the solution process, visual and kinesthetic subjects exhibit similarities. In the final phase, the auditory subject neither concludes nor responds to the initial questions.

Keywords: Learning style, auditory, visual, kinesthetic, math word problems

Abstrak

Pengumpulan informasi siswa sangat bergantung pada gaya belajar mereka. Pendidikan matematika membutuhkan pemeriksaan yang lebih dalam tentang variasi metodologis. Penelitian ini mengkaji korelasi antara gaya belajar siswa dengan kemampuan mereka dalam memecahkan soal cerita matematika yang melibatkan sistem persamaan linier dua variabel. Metode yang digunakan adalah metode penelitian deskriptif kualitatif. Instrumen yang digunakan adalah penilaian bakat dan gaya belajar siswa. Metode analisis data meliputi pengumpulan data, reduksi data, dan interpretasi data. Temuan termasuk bahwa subjek visual dan auditori hanya menyelesaikan tiga dari lima pertanyaan yang mereka anggap sederhana. Relatif, subjek kinestetik mampu menjawab empat pertanyaan. Pada saat memeriksa ulang mata pelajaran visual, auditori, dan kinestetik, jawaban yang diperoleh tidak diperiksa ulang. Dengan menyimpulkan proses penyelesaian, subjek visual dan kinestetik menunjukkan kesamaan. Pada fase akhir, subjek auditori tidak menyimpulkan atau menjawab pertanyaan awal.

Kata Kunci: Gaya belajar, auditori, visual, kinestetik, soal cerita matematika

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INTRODUCTION

Today's advances in science and technology must be linked to the function of education. In order to improve the quality and potential of education in Indonesia, families, communities, and the government must share responsibility for education, bearing in mind the importance of education (Sujana, 2019; Santika, 2021). Through education, a person's attitude and behavior will experience a process of transformation or formation (Putra, 2017; Zafi, 2018; Susiana et al., 2019). Students must be able to think critically, systematically, logically, and creatively and be willing to work together effectively (Marliani, 2015; Rachmantika & Wardono, 2019). Because mathematics has a strong and clear structure and interrelationships between concepts, it allows students to develop rational thinking

skills (Lestari, 2014; Suryapusparini et al., 2018). Therefore, students must be trained and conditioned to think independently.

Mathematics is an important component in everyday life and the advancement of other sciences. Because mathematics is a tool for logical thinking and systematic learning, all students, from elementary to advanced levels, must take mathematics courses (Tanjung & Nababan, 2018; Sudiarta et al., 2021). Mathematics is often considered difficult, boring, and uninteresting (Mailani, 2015; Imran et al., 2019; Permatasari, 2021).

Complex math problems are often presented in story form. Word problems require a deeper level of understanding and reasoning and a higher level of critical thinking due to the complexity of the questions and word length (Khishaalussaniyyati et al., 2023). Therefore, students must have a high level of understanding and accuracy. To solve mathematical problems, students must master basic mathematical concepts (Ginancar, 2019).

Solutions to problems depend on the final answer and problem-solving methodology. How do they make sense of the known information and questions asked in the problem to create a mathematical model? If the problem requires pictures or tables, students must be able to illustrate it to find the solution.

Learning style is one of the factors that influence problem-solving thinking processes. Each student must have a unique learning style (Ridwan, 2017; Wilujeng & Sudihartinih, 2021). Effective learning is enhanced by individual awareness of their learning style and the learning styles of others (Sundayana, 2016; Herlambang et al., 2021). Learning style refers to how students process and absorb information from the learning process (Saputri, 2016; Purbaningrum, 2017). According to DePorter and Hernacki (Khoeron et al., 2014; Budiarti & Jabar, 2016), learning styles can be divided into three categories: visual learning styles based on what is seen, auditory learning styles based on what is heard, and kinesthetic learning styles based on movement and touch.

Every student has a learning style, and so does the teacher. Therefore, the teacher's and student's teaching styles are interrelated and mutually supportive factors that significantly affect the teaching and learning process (Ningrat et al., 2018; Hasibuan, 2021). The right learning style is crucial for academic success (Wibowo, 2016; Pardede, 2019). Therefore, teachers must pay attention to student learning styles because they must be assisted and directed to identify learning styles that suit them so that learning objectives can be achieved effectively.

Observations made by researchers at SMP Negeri 2 Kotamobagu revealed that many students complained when studying mathematics because they often had difficulty solving the problems given. In addition, according to the researcher's interview with one of the eighth-grade math teachers, students often need to refine the steps needed to solve SPLDV word problems because of the difficulties they encounter when working on SPLDV story problems. When given SPLDV story problems, students experienced the following difficulties: (1) difficulty using known elements and being unable to model

the problem as a two-variable linear equation, even though the steps for solving it had been explained; (2) they have difficulty counting, including adding, subtracting, multiplying, and dividing positive and negative numbers; and (3) they have difficulty determining the outcome.

According to the data collected by the researcher, even when the teacher explained how to solve word problems, it needed to follow the characteristics of the students. Apart from teacher learning, student characteristics also play a role in whether or not a student understands the concept of a subject (Sodik et al., 2019; Andriani & Wakhudin, 2020). The learning style of these students is one of their characteristics (Widayanti, 2013; Adawiyah et al., 2020). Learning style is an individual's preferred method of receiving and processing information from the environment (Widayanti, 2013; Ramlah et al., 2014). Learning styles influence students' learning, determining the most effective educational methods (Putri et al., 2021). More efficient learning methods can help capture and understand a topic (Dewi, 2018; Salsabila et al., 2020). Recognizing one's learning style does not necessarily make one smarter, but knowing how to maximize one's learning abilities to achieve an optimal understanding of the material (Indra, 2017; Djunaidi, 2020; Fitria & Mawarni, 2023).

The researcher intends to conduct research based on the context above with the title Analysis of Student Learning Styles in Solving Mathematical Problems Stories on the Material of Two-Variable Linear Equation Systems.

METHOD

This study uses a descriptive methodology with a qualitative research approach. The research was carried out in odd semesters for the 2021–2022 school year at SMP Negeri 2 Kotamobagu. Class VIII B of SMP Negeri 2 Kotamobagu is the first research group comprising 17 students. The instruments used were a learning style questionnaire, the test of students' ability to answer story questions from SPLDV material, and interviews. Using a questionnaire to collect data about learning styles. Questionnaire responses will reveal future student learning styles. Before using the questionnaire, it must be tested for validity. The exam will be used to gather student information to answer SPLDV questions. Prior to the implementation of the exam, the validity of the items will be evaluated. This study used interviews to gather information about students' test-taking abilities. The data analysis technique used by Miles and Huberman begins with data reduction of learning style questionnaires, tests, and interviews. The information is then presented as narrative text. After saying and doing, it can be concluded that students' learning styles are different when solving word problems related to SPLDV.

RESULT AND DISCUSSION

This information was collected from three SMP Negeri 2 Kotamobagu grade VIII students. Each of the three students has a unique learning style: one has a visual learning style, one has an auditory learning style, and the other has a kinesthetic learning style. To make this selection, 17 students were given a learning style questionnaire. This study used a learning style questionnaire to collect data about

students' learning styles and test students' ability to solve word problems to evaluate their ability to solve problems involving SPLDV content.

The learning styles questionnaire consists of thirty statements. Two UNIMA mathematics professors validated this questionnaire before using it. Validation focuses on the questionnaire's quality, the statements' appropriateness, and the language used. Generally, the validation results of the learning style questionnaire are valid. The validator provides suggestions that are more language specific. The word problem-solving ability test for SPLDV material consists of five questions. Two experts consisting of two mathematics lecturers from UNIMA and one mathematics instructor from SMP Negeri 2 Kotamobagu, first validated the question. Attached are the names of validators who test the ability to answer story-based questions. The results of the validation of story problem-solving skills are generally reliable.

On Monday, 30 October 2022, the first step in data collection was to give questionnaires to seventeen class VIIIb students. Tuesday, 31 October 2022, marks the second stage of distributing test questions. The exam was given to three students: one with a visual learning style, one with an auditory learning style, and one with a kinesthetic learning style. The third step is to conduct interviews with the three students on Tuesday, 31 October 2022, between 10.30 and 12.00. A voice recorder was used for all interviews.

Student Data on Visual Learning Styles

①. Dik : 3 kg alpucad dan 2 kg Mangga = Rp : 56.000
2 kg alpucad dan 3 kg mangga: Rp : 54.000
Dit : Berapa harga 3kg alpucad ?
Penyelesaian : mis = x = alpucad
 y = Mangga

$$\begin{aligned} 3x + 2y &= 56.000 \quad \text{---(1)} \\ 2x + 3y &= 54.000 \quad \text{---(2)} \end{aligned}$$
$$\begin{array}{r} 3x + 2y = 56.000 \quad \times 3 \\ 2x + 3y = 54.000 \quad \times 2 \\ \hline 9x + 2y = 168.000 \\ 4x + 6y = 108.000 \\ \hline 5x = 60.000 \\ -x = 60.000 \\ \hline 5 = 12.000 \end{array}$$

Jadi harga 3kg alpucad = Rp. 12.000

Figure 1. Results of Visual Learning Style Student Work on Problem Number 1

In the picture above, students can understand the problem well. Students can write down all the elements that are known and ask questions. Next is the planning stage of the way of completion. It can

be seen that students can estimate the answers and the solution process by writing "e.g., $x = \text{avocado}$ and $y = \text{mango}$." Then also, students can change the known elements in the form of a mathematical model. After planning how to solve the problem, the next step is to implement the plan how to solve the problem. At this stage, students can plan to problem-solve properly. Students use all known elements to solve problems. Then students eliminate both equations and get $x = 12,000$. The final stage is review. At this stage, the student shows that he has re-examined his work and draws conclusions by writing, "So, the price of 1 kg of avocado = IDR 12,000".

P : Hi Noldi, I would like to ask a few questions about the results of your earlier work.

S : Yes, enci.

Q : Fine, relax. Is this question easy, medium, or difficult?

S : Easy to smell

Q : Ok. What is known about the problem?

S : 3 kg of avocado and 2 kg of mango is IDR 56,000.00

2 kg of avocado and 3 kg of mango is IDR 54,000.00

Q : Yes, that is right. What is the problem with question number 1?

S : The problem is finding the price of 1 kg of avocados.

Q : What method did you use to solve this problem?

S : Elimination

Q : Can you explain?

S : Yes, enci, can you explain using everyday language? Hehehehe

Q : Yes, please explain.

S : Ehmm, you were asked how much 1 kg of avocado costs. So if you want to find the price for an avocado, you have to eliminate y because what you are looking for is x . So the first equation is cased times 3 with the second equation cased times 2; after that, the result of the standard case times the case is less, kong can noh it x . (Ask how much 1 kg of avocado costs. So to solve it, eliminate y because you are looking for x . So the first equation is multiplied by 3 and the second by 2; after that, the product is subtracted, and you get x).

Q : Ok. In your opinion, this is a right or wrong answer! (Ok. Do you think this answer is right or wrong!)

S : Obviously, true sense.

Q : Sure? So double, check. (Are you sure? Have you checked again?).

S : Yes, enci, so sure, this is true. (Yes, I am sure it is true)

Student Data on Auditory Learning Styles

1. Dik : Nisa dan ibunya membeli 3 kg alpokat dan 2 kg mangga Rp. 56.000,00
Sedemikian > 2 kg alpokat dan 3 kg mangga Rp. 54.000,00.
Dit : Berapa harga 1 kg alpokat ?
penyelesaian: misalkan :
x : alpokat
y : mangga
$$\begin{array}{r} 3x + 2y = 56.000,00 \quad | \times 3 \\ 2x + 3y = 54.000,00 \quad | \times 2 \\ \hline 9x + 6y = 168.000 \\ 4x + 6y = 108.000 \quad - \\ \hline 5x = 60.000 \\ x = \frac{60.000}{5} \\ x = 12.000 \end{array}$$

Figure 2. Results of Auditory Learning Style Student Work on Problem Number 1

The picture above shows that students can understand the data that is known and asked in the questions. The next stage is planning a way of completion. Students can plan how to solve problems at this stage by writing, "For example, $x = \text{avocado}$; $y = \text{mango}$. Then students can change the known elements into mathematical models, even though students do not write which are the first and second equations. However, students understand so they can plan the solution correctly.

The next stage is the implementation of problem-solving methods. At this stage, students can carry out problem-solving methods properly. Students eliminate the first equation, $3x + 2y = 56,000$, and the second equation, $2x + 3y = 54,000$, so they get $x = 12,000$. The final stage is review. At this stage, students need to review their answers and return answers to the original question.

Q : Good afternoon Alia. Enci will interview a little about the question earlier.

S : Fine enci.

Q : In Alia's opinion, is this easy, medium, or difficult?

S : Easy to smell

Q : What do you know about the problem?

S : 3 kg of avocado and 2 kg of mango IDR 56,000.00

2 kg of avocado and 3 kg of mango IDR 54,000.00

Q : Ok. If so, what problems are there in this matter?

Q : How much does 1 kg of avocado cost.

Q : What method did you use?

S : Elimination

Q : Can you explain?

S : Eliminate the first and second equations to get $x = 12,000$.

- Q : Oh, I see. If asked, 1 kg of mango =...? Can you finish it?
- S : Yes, enci. All that's left is substituting $x=12,000$ into the first or second equation. (Yes, substitute $x=12,000$ into the first or second equation).
- Q : Yes, that is right. Are you sure about the answer you got? Have you checked again?
- S : Sure.
- Q : Can you summarize the final results?
- S : So the price of 1 kg of avocado is IDR 12,000.00.

Kinesthetic Learning Style Student Data

1. Dik : 3 kg alpokat + 2 kg mangga = Rp. 56.000
 2 kg alpokat + 3 kg mangga = Rp. 54.000

Dit : Berapa harga 1 kg Alpokat?

Peny : misalkan : alpokat = x
 mangga = y

$$\begin{array}{r} 3x + 2y = 56.000 \quad | \times 3 \\ 2x + 3y = 54.000 \quad | \times 2 \\ \hline 9x + 6y = 168.000 \\ 4x + 6y = 108.000 \quad - \\ \hline 5x = 60.000 \\ x = \frac{60.000}{5} \\ x = 12.000 \end{array}$$

Jadi, harga 1 kg alpokat adalah Rp. 12.000

Figure 3. Results of Kinesthetic Learning Style Student Work on Problem Number 1

The picture above shows that students can understand all the known and asked elements. Next is the planning stage of how to solve it. In this stage, students can plan how to solve the problem. As shown in Figure 3, students, for example, x = avocado and y = mango. Students also use all known elements and change the two equations into a mathematical model, even though students do not write down which are the first equation and the second equation. However, students understand so they can plan the solution correctly.

After the stage of planning the way of completion, then implement the settlement plan. At this stage, students can carry out the solution properly. Students eliminate the first equation, $3x + 2y =$

56,000, and the second equation, $2x + 3y = 54,000$, to get the result $x = 12,000$. The final stage is review. As shown in Figure 3, students can show that they have checked their answers again and draw conclusions by writing, "so, the price of 1 kg of avocado is IDR 12,000.

Q : Good afternoon Vanda. Let us get straight to the interview process, shall we?

S : Yes, enci.

Q : In your opinion, is this question easy, moderate, or difficult?

S : Easy to smell

Q : What do you know about the problem?

S : 3 kg of avocado + 2 kg of mango = IDR 56,000

2 kg of avocado + 3 kg of mango = IDR 54,000

Q : Ok. If so, what problems are there in this matter?

S : Eee, the price of 1 kg of avocado.

Q : What method did you use to solve this problem?

S : Elimination.

Q : Can you explain?

S : If you want to solve the problem, the first equation is multiplied by 3, and the second is multiplied by 2, so the y value is the same. After that, you get $x = 12,000$. (To solve this problem, the first equation is multiplied by 3, and the second equation is multiplied by 2 so that the y values are the same. Then we get $x = 12,000$).

Q : Why did you multiply the number 3 in the first equation and the number 2 in the second? Why not another number?

S : So it is easy for you to count enci. (So easy to calculate).

Q : Oh, I see. Are you sure about the answer you got? Checked again?

S : We will check it again. Let us be sure of the answer. (I did not double-check, but I am confident in the answer).

Q : Ok then.

CONCLUSION

Based on the results of the tests and interviews, the visual, auditory, and kinesthetic abilities of the subjects at the stage of understanding the problem have similarities, including the ability to write down what is known and what is asked in the questions, as well as the use and application of appropriate methods in solving problems. In planning and carrying out the steps for completing the three subjects, they can create and implement problem-solving strategies based on the concepts they learn. The visual and auditory subjects only completed three of the five questions they considered simple, while the kinesthetic subjects were able to complete all five. When re-examining visual, auditory, and kinesthetic subjects, the answers obtained were not re-examined. By concluding the completion process, visual and

kinesthetic subjects show similarities. In the final phase, the auditory subject does not conclude or answer the initial questions.

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