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An Analysis of Students' Mathematical Problem-Solving Ability at Class VII Social Arithmetic Materials Based on Learning Styles

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Abstract

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Learning style is an activity of thinking, processing, and understanding something that is preferred and has the characteristics of each person. Moreover, problem-solving ability is a skill that needs to be possessed in the process of solving mathematical problems. This study aims to describe students' problem-solving abilities on social arithmetic material in terms of learning styles. The research was conducted through a descriptive qualitative research design. The subject population was all seventh-grade students of MTs Al-Khairiyah, South Jakarta. Sampling was conducted using a total sampling technique. Three students were selected, namely students who scored the highest visual, auditory, and kinesthetic learning styles. The instrument used a learning style questionnaire and a test of problem-solving skills and semi-structured interviews—data analysis techniques with data reduction, exposure, and concluding to explain mathematical problem-solving abilities. The findings of this study were that students with the highest scores of visual, auditory, and kinesthetic learning styles can solve social arithmetic problems based on Polya's steps without any significant differences. They only have different styles when solving problems.

Keywords: problem-solving ability, learning style

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INTRODUCTION

As technology develops, the focus of mathematics education gradually changes from learning achievement to increasing various abilities (Tan & Ang, 2016; Umam & Kowiyah, 2018). An assessment score indicates learning achievement. Nonetheless, the process in learning to seeks improvement in abilities, including communication, problem-solving, critical, and creative thinking is considered more important (Sanders, 2016; Umam, 2018). In line with the view, National Council of Teachers of Mathematics (NCTM) sets five standards for learning mathematics: problem-solving, reasoning, connection, communication, and representation (Dahar, 2011; NCTM, 2000).

Problem-solving skills trigger students to think systematically, logically, critically, and never give up on problems. In this case, mathematics is part of a tool to train students to be proficient in solving problems and building thinking processes. In problem-solving, a person performs analysis, prediction, reasoning, evaluation, and reflection (Anderson, 2009; Phonapichat et al., 2014). Schools' mathematics curriculum views problem-solving as the main activity, as contained in the 2013 curriculum (Kurniasih & Sani, 2014; Warli, 2014). Various aspects have been prepared in K 13, which was developed to prepare generations with characters. Planning and selection of appropriate learning methods are

efforts to be made in the training of problem-solving ability; a specification that is essential in achieving the purpose of the learning process (Cahyani & Setyawati, 2016; Soebagyo, 2018; Wahyudin, 2008). Problem-solving is related to discovery, using logic, inductive and deductive discovery processes, as well as making decisions with a specific purpose (Alexander, 2012; Lakatos, 1976; Polya, 1978; Simon, 1991).

In the learning process, a teacher should have basic knowledge about the learning styles of the students. Gunawan (2007) explains that the students' learning style is how the students do the thinking, process, and understanding of the information obtained (Syofyan, 2017; Syukur & Misu, 2014). Each student has a different learning style. In the case of learning mathematics, there are students who find mathematics easy to understand and some find it difficult to understand. Some students like it when the teachers teach by writing, conveying orally or like small group learning for discussion. There are even students who wish when the teacher uses props. This situation shows the diversity of learning styles possessed by students. The Neuro-Linguistic Programming expert explained three human learning styles: visual, auditory, and kinesthetic (Lestari et al., 2017; Wikanengsih, 2012). Visual learning style dominates in visual acuity, and it is easier or faster to understand by seeing. The auditory learning style relies more on hearing in understanding and remembering. This learning style likes to talk, discuss or explain. At the same time, the aesthetic learning style is learning by moving, touching, or working.

Someone can experience their learning style when they feel comfortable, safe, and easy to understand when learning. A person chooses a learning style according to him/herself in obtaining information and knowledge in the learning process. Learning style is a consistent way, a habit that a person does to reveal information, experiences for thinking, remembering, and solving problems in learning (Nasution, 2011; Sundayana, 2018). Learning styles are essential to make the learning process fun and to get satisfactory results because individuals will feel comfortable carrying out learning activities.

Gunawan said that students who use a dominant learning style in studying, taking tests would get higher scores than students who study not in accordance with their learning style (Mustafida, 2013; Prianto, 2013). Meanwhile, DePorter and Hernacki stated that the learning style combines students' ways of processing, absorbing, and organizing information, (Mufidah, 2017; Wassahua, 2016). Besides Fleming & Mills, learning style is the tendency of students to use strategies in learning (Minarti, 2013; Seyal & Rahman, 2015).

The views of Neuro-Linguistic Programming explain that there are three human learning styles, namely visual, auditory and kinesthetic (Lestari et al., 2017). Visual learning style dominates in visual acuity, and it is easier or faster to understand by seeing. The auditory learning style relies more on hearing in understanding and remembering. This learning style likes to talk, discuss or explain. In contrast, the aesthetic learning style is learning by moving, touching, or working.

PRISE research in Indonesia released a study that stated that the ability to solve simple math problems was almost the same between new students entering elementary school and those who had graduated from high school (Okenews, 2018). Additionally, research related to difficulties of students in solving mathematical problems have been carried out. Among them include student difficulties in solving the problem of multiple interpretations of the given problem, the lack of prior knowledge, and the lack of mathematical literacy (Buschman, 2020; Wang, 2003). In addition, the lack of knowledge and understanding of students when performing arithmetic operations, whereby students who have low abilities will perform arithmetic operations randomly without knowing the correct procedures (Sutrisno, 2015; Zhang et al., 2014).

The importance of problem-solving in learning mathematics to gain experience from using knowledge and skills in solving complex problems is crucial. Solving math

problems involves using prior knowledge to solve new situations (Mulyati, 2016; Yarmayani, 2016). An overview of problem-solving as the primary process when learning mathematics occurs in the classroom (Umam, 2018; Winarti et al., 2019). Problem-solving is a focused thought to determine the solution to a specific problem (Mawaddah & Anisah, 2015). In line with that, Gunantara argues that problem-solving includes the skills or potential of students to solve the problems and apply them in everyday life (Gunantara, 2014).

Polya (1973) explains the stages to solve problems include: 1) Understanding the problem, 2) Planning a strategy, 3) Implementing the plan, and 4) Re-examining (Luluk, 2019; Netriwati, 2016). The ability to understand the problem can be seen by mentioning what is known, asked, and the conditions given in a problem. Afterwards, it is important to see the relationship between the information obtained with previous knowledge or experience as evidenced by completing the steps. After understanding the problem and developing a plan, then the plan is then carried out. The last step is to re-examine the results so that it can find results as expected. Each student has differences in carrying out the problem-solving process depending on the level of mathematical reasoning they have (Joko S, 2021). This situation happens because of differences in intelligence, thinking skills, creativity, interests, attitudes, and cognitive styles.

The researchers' initial observations to several students at MTs in Jakarta found answers regarding social arithmetic materials. In solving problems, some students have not been systematic, some solve the problems well, and some solve with Polya's steps. Indicators in problem-solving are understanding the problem, formulating a plan, implementing the project, and checking again. In the previous research, we found that the four phases of Polya in solving linear story questions, based on student beliefs, have a different level (Soebagyo et al., 2021). It makes it more interesting for us to know in another way.

Based on the previous explanation, by knowing the learning style, the teacher can maximize mathematical learning, especially problem-solving. Therefore, in this research, the profiles of students' mathematical solving ability on social arithmetic material will be examined in terms of students' learning styles.

METHODS

The type of research used is descriptive to describe students' problem-solving abilities on social arithmetic material regarding learning styles. Students were first divided into two groups based on visual and auditory learning styles, then given social arithmetic questions containing stories to find out the problem-solving profile of each group. The results of the students' answers were analyzed according to the indicators of problem-solving ability.

Subject Selection

The population in this study were all seventh-grade students at MTs Al-Khairiyah Mampang Prapatan Jakarta 2020/2021. The number of students was 131 consisting of 4 classes. The sample selection was the total sampling technique (see table 1). In comparison, the subjects in this study were two students, one student with a visual learning style and one student with an auditory learning style who had the highest score.

Table 1. Sample Demographics

| Category | Sum | |
|------------------------------------|----------|----|
| Gender | Boy | 58 |
| | Girl | 73 |
| Learning Style | Visual | 65 |
| | Auditory | 66 |
| Learn Maths during a pandemic with | Mobile | 94 |
| | Laptop | 37 |

Data were collected through preliminary observations, learning style questionnaires and problem-solving ability tests, and structured interviews. The learning style questionnaire was conducted to obtain student data on learning styles. The problem ability test was given to students who have visual and auditory learning styles with the highest scores using questions to three students of class VII-C. From the results of students' work, answers to the questions given were obtained. Questions and answers as research data were then analyzed based on problem-solving ability indicators, namely 1) Understanding the problem, 2) Planning, 3) Implementing planning, and 4) Re-examining (see table 2). From the results of data analysis, the profiles of students' problem-solving abilities were described.

Table 2. Problem Solving Indicators According to Polya (Polya, 1978)

| Indicators | Criteria for Knowledge Construction Activities |
|------------------------|--|
| Understanding Problems | Students can identify problems by showing what is known, asked, and the completeness of the elements needed |
| Devise a Plan | Students can determine the formula or initial method of completion, can conduct investigations for problem-solving |
| Carrying out a Plan | Students carry out the plan by completing the planned steps |
| Looking Back | Students re-examine the results of the completion to ensure the work steps are following the procedure |

The data obtained were about learning styles and mathematical problem-solving abilities which require valid instruments. The researcher was the main instrument, who was assisted by three other tools: a learning style questionnaire, a social arithmetic test, and an interview guide. The learning style questionnaire was adopted from Bobby Deporter, Mark Reardon, & Srah Singer-Nourie to determine students' learning styles. The test of mathematical problem-solving ability is a matter of social arithmetic material in-story questions.

Traders bought 630 oranges. Then he sold 315 oranges for Rp. 2.300,-/fruit, another 200 oranges for Rp. 2.800,-/fruit and the rest are not sold because they are rotten. If the trader earns a profit of Rp. 276.500,-, how much is the price to buy one orange!

The data in this study was to classify students' learning styles and problem-solving abilities. The resulting data was then analyzed qualitatively using the stages of reduction, presentation, and conclusion drawing to determine the profile of students' mathematical problem-solving skills (Miles, M. B., & Huberman, 1994)

RESULTS & DISCUSSION

Results

Student Learning Style

The results of the learning style questionnaire data can be seen in the table below:

Table 3. Learning Style Questionnaire Results

| Learning Style | Frequency | Percentage |
|----------------|-----------|------------|
| Visual | 67 | 51.1% |
| Auditory | 45 | 34.4% |
| Kinesthetic | 19 | 14.5% |
| Sum | 131 | 100% |

S1 Troubleshooting Process with Visual Learning Style

Diketahui: pedagang membeli jeruk 630 buah
 terjual 315 harga 2.300/buah
 terjual 200 harga 2.800/buah
 Pedagang memperoleh keuntungan Rp. 276.500.

Ditanya: Harga beli satu buah jeruk?

Jawab:

Jumlah jeruk = 630
 > harga jual 315 x 2.300 = 724.500
 > harga jual 200 x 2.800 = 560.000
 total penjualan = 1.284.500
 keuntungan = 276.500

maka harga beli = Rp. 1.284.500 - Rp. 276.500 = ~~Rp. 1.008.000~~

harga per jeruk = Rp. 1.008.000 / 630
 = Rp. 1600.

Figure 1. S1 Troubleshooting Process

Discussion

Based on Table 3, of 131 students, 67 students (51.1%) have visual learning style, 45 students (34.4%) have auditory learning style, and 19 students (14.5%) have kinesthetic learning style. The results of observations and interviews of researchers with several students who have visual learning styles showed similarities to the Mufidah and Wassahua's research results, discovered states that they tend to prefer when the teacher or friend is explaining; In addition, they tend to like to argue or tell stories about the materials being studied (Mufidah, 2017; Wassahua, 2016).

Profile of Math Problem Solving Ability Visual Learning Style

Based on S1's answer and the validity check, interviews were conducted. Below are excerpts of an interview with S1.

R: *When you first saw the question, what did you think? (P01)*

S1: *The question about social arithmetic in the buying and selling section, Ms. (S101)*

R: *What do you understand from this question? (P02)*

S1: *There is a selling price of oranges, whereby 315 oranges cost IDR 2,300. Another 200 oranges for IDR 2,800. The number of oranges bought by the seller is 630, meaning that rotten ones are not sold. In addition, the seller's profit is known. What you are looking for is the purchase price of one orange (S102)*

R: *Okay then, what steps did you take? (P03)*

S1: *First, I counted the sales of 315 oranges, then the sales of 200 oranges. From there we know the total sales. If you ask the purchase price, then the selling price - profit (S103)*

R: *Quite detailed in explaining the steps. If you have finished working, do you re-correct the work? (P04)*

S1: *Of course ma'am, moreover, this number is not pretty hehe (S104)*

Based on the results of problem-solving and interviews with S1, it appeared that S1 could solve problems well. S1 explained the information from the questions given accurately and adequately, namely known and asked (S102), making plans in solving problems according to procedures (S103), and re-examining the work results (S104). S1 could carry out four stages of problem-solving according to Polya. In this case, S1 can be classified as a student with high mathematical problem-solving abilities (Fatmawati & Murtafiah, 2018; Samo, 2017; Sari, 2017; Sumartini, 2016).

Profile of Math Problem Solving Ability Auditory Learning Style

Based on the answers of S2 and the validity check of the data, the researchers conducted interviews with S2. Below are excerpts of an interview with S2.

R: *When you first saw the question, what did you think? (P01)*

S2: *Looking for the purchase price of one orange, this is about social arithmetic, ma'am. (S201)*

R: *What do you understand from this question? (P02)*

S2: *From the question, it is known that the number of oranges purchased was 600, then 315 were sold for IDR 2,300/fruit, 200 oranges were sold for IDR*

2,800/fruit. The rest doesn't count as sold because it's rotten. The advantage of the question is already known, so to find the purchase price, use the formula for selling price less profit (S202)

R: What are you planning to do to solve this problem? (P03)

S2: First, calculate the selling price, which consists of 315 oranges and 200 oranges. Then look for the purchase price = selling price - profit (S203)

R: Quite detailed in explaining the steps. If you have finished working, do you re-correct the work? (P04)

S2: Trying to be thorough, but I still corrected the results that have been done, Mrs. (S204)

Based on the results of problem-solving answers and interviews with S2, it appeared that S2 could solve the problems well. S2 could explain information from the questions appropriately given and accurately, that is, known and asked (S202), making plans in solving problems according to procedures (S203), and re-examining the results of work that was not carried out by S2 (S204). S2 can do the problem-solving stage, according to Polya. S2 can be classified as a student with good mathematical problem-solving skills (Irianti, 2020; Mairing et al., 2011; Rani & Istiqomah, 2019; Risani & Nuriyatin, 2021).

Profile of Math Problem Solving Ability Kinesthetic Learning Style

Based on the answer S3 and the validity check, the researchers conducted interviews with S3. Below are excerpts of an interview with S3.

R: When you first saw the question, what did you think? (P01)

S3: About Social Arithmetic Mrs. (S301)

R: What do you understand from this question? (P02)

S3: It is known that the selling price of oranges is different, namely IDR 2,300/fruit and IDR 2,800/fruit. In addition, the profit from the sale is known. What is being asked is the purchase price of each orange, Mrs. (S302)

R: So, from the information on the questions, what are your plans to solve the problem? (P04)

S3: First, calculate the selling price of 315 oranges, then 200 oranges. Then the total sales - profits are then divided by 630 for the price of each fruit. (S304)

R: Oh, that's right, if you have finished working on it, will your work be corrected again? Why is something crossed out of the previous answer? (P05)

S3: God willing, I always correct ma'am, so why do I cross out something? Because at first, I miscalculated ma'am, hehe (S305)

Based on the results of the work and interviews with S3, it can be seen that S3 understood the problem (S302 & S303) and could plan well (S304). However, in implementing the plan, S3 made an error in determining the interest rate. Nonetheless, S3's process of re-checking discovered a mistake in the calculation shown by the cross-out answers (S305). Errors in carrying out the plan are usually seen from the incompatibility of the mathematical model, completion steps, mastering some concepts and working strategies (Isnaeni et al., 2018; Komarudin, 2016; Nurdiana, 2017). Re-examining needs special attention because it is essential in solving mathematical problems to minimize technical errors, but few students feel confused about what to do in re-examining (Irfan, 2017; Kristofora & Sujadi, 2017; Ruswati et al., 2018).

CONCLUSION

From the observations of 3 subjects who have visual, auditory, and kinesthetic learning styles with the highest scores, it can be concluded that students with visual learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, formulating plans, implementing plans, and re-examining. Students who have a good visual learning style have the following characteristics: neat, orderly, thorough, and detailed, prioritizing appearance. Students with auditory learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, making plans, implementing plans, and re-checking. Students with auditory learning styles were seen reading a little more complicatedly in the problem-solving process, sometimes easily to be distracted. Students with kinesthetic learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, making plans, implementing plans, and re-checking. Students occasionally tap the table and their feet on the floor as if doing specific movements will provide a sense of comfort to provide stimulation in solving mathematical problems. There was no significant difference in students' problem-solving with visual, auditory, and kinesthetic learning styles. However, it can only be seen from the body gestures and attitudes that appear when solving mathematical problems.

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#10099 Summary

SUMMARY REVIEW EDITING

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| Authors | Joko Soebagyo, Khoerul Umam, Istikharoh Istikharoh, Huri Suhendri |
| Title | An Analysis of Students' Mathematical Problem-Solving Ability at Class VII Social Arithmetic Materials Based on Learning Styles |
| Original file | 10099-28221-1-SM.DOCX 2021-07-07 |
| Supp. files | None |
| Submitter | Joko Soebagyo |
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PROFILE OF STUDENTS' MATHEMATIC PROBLEM-SOLVING ABILITY AT CLASS VII SOCIAL ARITHMETIC MATERIALS ASSESSED FROM LEARNING STYLE

Joko Soebagyo (*), Khoirul Umam, Istikharoh, Huri Suhendri
Universitas Muhammadiyah Prof. Dr. Hamka, Jakarta, Indonesia

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Abstract

Learning style is an activity of thinking, processing, and understanding something that is preferred and has the characteristics of each person. Problem-solving ability is a skill that needs to be possessed in the process of solving mathematical problems. This study aims to describe students' problem-solving abilities on social arithmetic material in terms of learning styles. The research was conducted through a descriptive qualitative research design. The population is all seventh-grade students of MTs Al-Khairiyah, South Jakarta. Sampling using a total sampling technique. Then three students were selected, namely students who scored the highest visual, auditory and kinesthetic learning styles. The instrument uses a learning style questionnaire and a test of problem-solving skills and semi-structured interviews—data analysis techniques with data reduction, exposure, and concluding to explain mathematical problem-solving abilities. The findings of this study are students with the highest scores of visual, auditory, and kinesthetic learning styles can solve social arithmetic problems based on Polya's steps without any significant differences, only from different styles when solving problems.

Keywords: problem-solving ability, learning style

(* Corresponding Author: joko_soebagyo@uhamka.ac.id 082112391355.

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INTRODUCTION

As technology develops, the focus of mathematics education gradually changes from learning achievement to increasing various abilities (Tan & Ang, 2016; Umam & Kowiyah, 2018). An assessment score indicates learning achievement, but what is more important is the process in learning that seeks to improve abilities, including communication, problem-solving, critical and creative thinking (Sanders, 2016; Umam, 2018). In line with that, NCTM sets five standards for learning mathematics: problem-solving, reasoning, connection, communication, and representation (Dahar, 2011; NCTM, 2000).

Problem-solving skills lead students to think systematically, logically, critically and never give up on problems. So that mathematics is part of a tool to train students to be proficient in solving problems and building thinking processes. In problem-solving, a person performs analysis, prediction, reasoning, evaluation, and reflection (Anderson, 2009; Phonapichat et al., 2014). The school mathematics curriculum views problem-solving as the main activity, so it is contained in the 2013 curriculum (Kurniasih & Sani, 2014; Warli, 2014). Various aspects have been prepared in K 13, which was developed to prepare generations with character. Make the planning, selection of appropriate learning methods are efforts to be made in the training of problem-solving ability; a specification is essential in achieving the purpose of the learning process (Cahyani & Setyawati, 2016;

- R: *When you first saw the question, what did you think? (P01)*
S2: *Looking for the purchase price of one orange, this is about social arithmetic, ma'am. (S201)*
R: *What do you understand from this question? (P02)*
S2: *From the question, it is known that the number of oranges purchased was 600, then 315 were sold for Rp. 2,300/fruit, 200 oranges were sold for Rp. 2,800/fruit. The rest doesn't count as sold because it's rotten. The advantage of the question is already known, so to find the purchase price, use the formula for selling price less profit (S202)*
R: *What are you planning to do to solve this problem? (P03)*
S2: *First, calculate the selling price, which consists of 315 oranges and 200 oranges. Then look for the purchase price = selling price - profit (S203)*
R: *Quite detailed in explaining the steps. If you have finished working, do you re-correct the work? (P04)*
S2: *Trying to be thorough, but I still corrected the results that have been done, Mrs. (S204)*

Based on the results of problem-solving answers and interviews with S2, it appears that S2 can solve problems well. S2 can explain information from the questions appropriately given and accurately, that is, it is known and asked (S202), makes plans in solving problems according to procedures (S203), re-examines the results of work not carried out by S2 (S204). S2 can do the problem-solving stage, according to Polya, so S2 is classified as a student with the category of having good mathematical problem-solving skills (Irianti, 2020; Mairing et al., 2011; Rani & Istiqomah, 2019; Risani & Nuriyatin, 2021).

Profile of Math Problem Solving Ability Kinesthetic Learning Style

Penyelesaian :

Dik :

- Jumlah keseluruhan jeruk = 600 buah
- 315 jeruk dijual sehingga 2300/buah
 $= 315 \times 2300 = \text{Rp. } 724.500$
- 200 jeruk dijual sehingga 2800/buah
 $= 200 \times 2800 = \text{Rp. } 560.000$
- Keuntungan = Rp. 276.500

Dit :

Berapa harga beli satu buah jeruk ?

Jawab :

harga beli = Total dari (Penjualan - Keuntungan)
 $= (\text{Rp. } 724.500 + \text{Rp. } 560.000) - \text{Rp. } 276.500$
 $= 1.284.500 - 276.500$
 $= 1.008.000$

harga beli satu jeruk
 $= 1.008.000 : 600$
 $= 1.680$

Jadi harga beli satu jeruk Rp. 1.680

Figure 3. S3 Troubleshooting Process

Based on the answer S3, then in checking the validity of the researchers conducted interviews with S3. Below are excerpts of an interview with S3.

- R: *When you first saw the question, what did you think? (P01)*
S3: *About Social Arithmetic Mrs. (S301)*
R: *What do you understand from this question? (P02)*
S3: *It is known that the selling price of oranges is different, namely Rp. 2,300/fruit and Rp. 2.800/fruit. In addition, the profit from the sale is known. What is being asked is the purchase price of each orange, Mrs. (S302)*
R: *So, from the information on the questions, what are your plans to solve the problem? (P04)*
S3: *First, calculate the selling price of 315 oranges, than 200 oranges. Then the total sales - profits are then divided by 630 for the price of each fruit. (S304)*
R: *Oh, that's right, if you have finished working on it, will your work be corrected again? Why is something crossed out of the previous answer? (P05)*
S3: *God willing, I always correct ma'am, so why do I cross out something, because at first, I miscalculated ma'am, hehe (S305)*

Based on the results of the work and interviews with doctoral degrees, it can be seen that doctorates understand the problem (S302 & S303) and can plan well (S304). However, in implementing the plan, S3 made an error in determining the interest rate. However, S3 process re-checking can realize a mistake in the calculation so that it looks like there are streaks in the repair process (S305). Errors in carrying out the plan are usually seen from the incompatibility of the mathematical model and completion steps, mastering some concepts and working strategies (Isnaeni et al., 2018; Komarudin, 2016; Nurdiana, 2017). Re-examining needs special attention because the process of re-examining is essential in solving mathematical problems to minimize technical errors, but not a few students feel confused about what to do in the process of re-examining (Irfan, 2017; Kristofora & Sujadi, 2017; Ruswati et al., 2018)

CONCLUSION

From the observations of 3 subjects who have visual, auditory and kinesthetic learning styles with the highest scores, it can be concluded that students with visual learning styles are able to solve social arithmetic problems based on Polya's steps, namely understanding the problem, formulating plans, implementing plans and re-examining. Students who have a good visual learning style have the following characteristics: neat, orderly, thorough and detailed, prioritizing appearance.

Students with auditory learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, making plans, implementing plans and checking again. Students with auditory learning styles are seen reading a little more complicated in the problem-solving process, sometimes turning left and fitting when there is noise.

Students with kinesthetic learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, making plans, implementing plans and checking again. It can be seen that students occasionally tap the table and their feet on the floor as if doing specific movements will provide a sense of comfort to provide stimulation in solving mathematical problems.

There was no significant difference in students' problem solving with visual, auditory and kinesthetic learning styles. However, it can only be seen from the body gestures and attitudes that appear when solving mathematical problems.

Commented [WU6]: Cek kembali terjemahan dari S3 dalam konteks ini, apakah maksudnya siswa ketiga atau gelar akademik S3

Commented [WU7]: Simbol bilangan sebaiknya ditulis dalam bentuk kata/ suunan huruf.

Commented [WU8]: Urgensi penelitian ini belum ada. Sebaiknya diberikan ada bagian pendahuluan, sehingga pada bagian pembahasan dapat diberikan berbagai kontribusi dari penelitian ini untuk bidang pendidikan matematika.

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Soebagyo, 2018; Wahyudin, 2008). Problem-solving is related to discovery, using logic, inductive and deductive discovery processes, making decisions with a specific purpose (Alexander, 2012; Lakatos, 1976; Polya, 1978; Simon, 1991).

In the learning process, a teacher should have basic knowledge about the learning styles of the students. Gunawan (2007) explains that the student's learning style is how the students do the thinking, process and understanding of the information obtained (Syofyan, 2017; Syukur & Misu, 2014). Each student has a different learning style, so when learning mathematics, there are easy to understand, and some find it difficult to understand. Some students like it when the teacher teaches by writing conveys orally or likes small group learning for discussion, and there are even students who want it when the teacher uses props. This situation shows the diversity of learning styles owned by students. The Neuro-Linguistic Programming expert explained three human learning styles: visual, auditory, and kinesthetic (Lestari et al., 2017; Wikanengsih, 2012). Visual learning style dominates in visual acuity, and it is easier or faster to understand by seeing. The auditory learning style relies more on hearing in understanding and remembering. This learning style likes to talk, discuss or explain. At the same time, the aesthetic learning style is learning by moving, touching or working.

PRISE research in Indonesia released a study that stated that the ability to solve simple math problems was almost the same between new students entering elementary school and those who had graduated from high school (Okenews, 2018). Additionally, research related difficulties of students in solving mathematical problems have been carried out, of them student difficulties in solving the problem of multiple interpretations of the given problem, the lack of prior knowledge, the lack of mathematical literacy (Buschman, 2020; Wang, 2003). In addition, the lack of knowledge and understanding of students when performing arithmetic operations, for students who have low abilities will perform arithmetic operations randomly without knowing the correct procedure (Sutrisno, 2015; Zhang et al., 2014).

The researcher's initial observations to several students at MTs in Jakarta found answers regarding social arithmetic material. Some students in solving problems have not been systematic, but some students problem-solve well and solve problem-solving with Polya's steps. Indicators in problem-solving are understanding the problem, formulating a plan, implementing the plan and checking again.

Based on the previous explanation, by knowing the learning style, the teacher can maximize mathematical learning, especially problem-solving. So, in this research, the profile of students' mathematical solving ability on social arithmetic material will be examined in terms of students' learning styles.

Theoretical review

Learning Style

Someone can see their learning style when they feel comfortable, safe and easy to understand when learning. A person chooses a learning style according to himself in obtaining information and knowledge in the learning process. Learning style is a consistent way, a habit that a person does to reveal information, experiences for thinking, remembering and solving problems in learning (Nasution, 2011; Sundayana, 2018). Learning styles are essential so that the learning process is fun and gets satisfactory results because individuals will feel comfortable carrying out learning activities.

Gunawan said that students who use a dominant learning style in studying, taking tests would get higher scores than students who study not in line with their learning style (Mustafida, 2013; Prianto, 2013). Meanwhile, DePorter and Hernacki stated that the learning style combines students' ways of processing information, absorbing and

Commented [WU1]: Terdapat reduidansi 'solve', problem-solve'.
Sebaiknya diparafrase ulang, sehingga tidak ada lagi reduidansi.

organizing (Mufidah, 2017; Wassahua, 2016). Besides Fleming & Mills, learning style is the tendency of students to use strategies in learning (Minarti, 2013; Seyal & Rahman, 2015).

The opinion of Neuro-Linguistic Programming explains that there are three human learning styles, namely visual, auditory and kinesthetic (Lestari et al., 2017). Visual learning style dominates in visual acuity, and it is easier or faster to understand by seeing. The auditory learning style relies more on hearing in understanding and remembering. This learning style likes to talk, discuss or explain. In contrast, the aesthetic learning style is learning by moving, touching or working.

Problem-solving Ability

The importance of problem-solving in learning mathematics so that students can gain experience from using knowledge and skills in solving complex problems is crucial. Solving math problems involves using prior knowledge to solve problems in new situations (Mulyati, 2016; Yarmayani, 2016). An overview of problem-solving as the primary process when learning mathematics occurs in the classroom (Umam, 2018; Winarti et al., 2019). Problem-solving is a focused thought to determine the solution/solution to a specific problem (Mawaddah & Anisah, 2015). In line with that, Gunantara argues that problem-solving includes the skills or potential of students to solve the issues and apply them in everyday life (Gunantara, 2014).

Polya (1973) states the stages that are passed to solve problems include: 1) Understanding the problem, 2) Planning a strategy, 3) Implementing the plan, and 4) Re-examining (Luluk, 2019; Netriwati, 2016). The ability to understand the problem can be seen by mentioning what is known, asked and the conditions given in a problem. Next, look for the relationship between the information obtained with previous knowledge or experience as evidenced by compiling completion steps. After understanding the problem and developing a plan, then carry out the plan based on the plan that has been prepared. The last step is to re-examine the work results so that it can find results as expected. Each student has differences in carrying out the problem-solving process depending on the level of mathematical reasoning they have (Joko S, 2021). This situation happens because of differences in intelligence, thinking skills, creativity, interests, attitudes and cognitive styles.

METHODS

Types of research

The type of research used is descriptive description to describe students' problem-solving abilities on social arithmetic material in terms of learning styles. Students are first divided into two groups based on visual and auditory learning styles, then given social arithmetic questions containing stories to find out the problem-solving profile of each group. The results of the students' answers were analyzed according to the indicators of problem-solving ability.

Subject Selection

The population in this study were all seventh-grade students at MTs Al-Khairiyah Mampang Prapatan Jakarta 2020/2021. The number of students is 131 consisting of 4 classes, and then the sample selection is the total sampling technique (see table 1). In comparison, the subjects in this study were two students, one student with a visual learning style and one student with an auditory learning style who had the highest score.

Commented [WU2]: Mengapa hanya mengambil dua learning style? Mengapa tidak mengikutsertakan kinesthetic learning style

Table 1. Sample Demographics

| Category | | Sum |
|------------------------------------|----------|-----|
| Gender | Boy | 58 |
| | Girl | 73 |
| Learning Style | Visual | 65 |
| | Auditory | 66 |
| Learn Maths during a pandemic with | Mobile | 94 |
| | Laptop | 37 |

Data Collection Technique

Data were collected through preliminary observations, learning style questionnaires and problem-solving ability tests and structured interviews. The learning style questionnaire was conducted to obtain student data on learning styles. The problem ability test is given to students who have visual and auditory learning styles with the highest scores using questions to three students of class VII-C. From the results of student work, answers to the questions given are obtained. Questions and answers as research data are then analyzed based on problem-solving ability indicators, namely 1) Understanding the problem, 2) Planning, 3) Implementing planning and 4) Re-examining (see table 2). From the results of data analysis, the profile of students' problem-solving abilities is described.

Table 2. Problem Solving Indicators According to Polya (Polya, 1978)

| Indicators | Criteria for Knowledge Construction Activities |
|------------------------|--|
| Understanding Problems | Students can identify problems by showing what is known, asked, and the completeness of the elements needed |
| Devise a Plan | Students can determine the formula or initial method of completion, can conduct investigations for problem-solving |
| Carrying out a Plan | Students carry out the plan by completing the planned steps |
| Looking Back | Students re-examine the results of the completion to ensure the work steps are following the procedure |

Research Instruments

The data obtained are about learning styles and mathematical problem-solving abilities so that they require valid instruments. The researcher is the main instrument, then assisted by three other tools: a learning style questionnaire, a social arithmetic test, and an interview guide. The learning style questionnaire was adopted from Bobby Deporter, Mark Reardon, & Srah Singer-Nourie to determine students' learning styles. The test of mathematical problem-solving ability is a matter of social arithmetic material in-story questions.

Traders bought 630 oranges. Then he sold 315 oranges for Rp. 2.300,-/fruit, another 200 oranges for Rp. 2.800,-/fruit and the rest are not sold because they are rotten. If the trader earns a profit of Rp. 276.500,-, how much is the price to buy one orange!

Commented [WU3]: Sebaiknya diberikan deskripsi singkat terkait instrumen ini, seperti, berupa pertanyaan/ pernyataan yang diberikan, skala instrumennya menggunakan skala Likert atau Guttman dsb., Indikatornya apa saja?

Research Data Analysis

The data in this study is to classify students' learning styles and problem-solving abilities. The resulting data was then analyzed qualitatively using the stages of reduction, presentation and conclusion drawing to determine the profile of students' mathematical problem-solving skills (Miles, M. B., & Huberman, 1994)

RESULTS & DISCUSSION

Student Learning Style

The results of the learning style questionnaire data can be seen in the table below:

Table 3. Learning Style Questionnaire Results

| Learning Style | Frequency | Percentage |
|----------------|-----------|------------|
| Visual | 67 | 51,1% |
| Auditory | 45 | 34,4% |
| Kinesthetic | 19 | 14,5% |
| Sum | 131 | 100% |

Based on table 3, from 131 students obtained 67 students (51.1%) with visual learning style, 45 students (34.4%) with auditory learning style, and 19 students (14.5%) with kinesthetic learning style. The results of observations and interviews of researchers with several students who have a visual learning style show that they tend to prefer when the teacher or friends are explaining; besides, they tend to like to argue or tell stories about the material being studied (Mufidah, 2017; Wassahua, 2016).

Profile of Math Problem Solving Ability Visual Learning Style

Diketahui: pedagang membeli jeruk 630 buah
 terjual 315 harga 2.300/buah
 terjual 200 harga 2.800/buah
 pedagang memperoleh keuntungan Rp. 276.500.
 Ditanya: Harga beli satu buah jeruk?
 Jawab: jumlah jeruk = 630
 > harga jual 315 x 2.300 = 724.500
 > harga jual 200 x 2.800 = 560.000
 total penjualan = 1.284.500
 keuntungan = 276.500
 maka harga beli = Rp. 1.284.500 - Rp. 276.500 = Rp. 1.008.000
 harga per jeruk = Rp. 1.008.000 / 630
 = Rp. 1600.

Figure 1. S1 Troubleshooting Process

Based on S1's answer, then to check the validity of S1, interviews were conducted. Below are excerpts of an interview with S1.

Commented [WU4]: Terdapat siswa yang memiliki kinestetis Learning Style, ini tidak sejalan dengan cara pengambilan sampel yang sudah disebutkan sebelumnya

Commented [WU5]: Mungkin lebih baik jika diterjemahkan 'problem solving'

- R: When you first saw the question, what did you think? (P01)
 S1: The question about social arithmetic in the buying and selling section, Ms. (S101)
 R: What do you understand from this question? (P02)
 S1: There is a selling price of oranges, of which 315 oranges cost Rp.2300. Another 200 oranges for IDR 2,800. The number of oranges bought by the seller is 630, meaning that there are rotten ones not sold. In addition, the seller's profit is known. What you are looking for is the purchase price of one orange (S102)
 R: Okay then, what steps did you take? (P03)
 S1: First, I counted the sales of 315 oranges, then the sales of 200 oranges. From there we know the total sales. If you ask the purchase price, then the selling price - profit (S103)
 R: Quite detailed in explaining the steps. If you have finished working, do you re-correct the work? (P04)
 S1: Of course ma'am, moreover, this number is not pretty hehe (S104)

Based on the results of problem-solving and interviews with S1, it appears that S1 can solve problems well. S1 explains the information from the questions given accurately and adequately, namely known and asked (S102), making plans in solving problems according to procedures (S103) and re-examining the work results (S104). S1 can carry out four stages of problem-solving according to Polya, so S1 is classified as a student with high mathematical problem-solving abilities (Fatmawati & Murtafiah, 2018; Samo, 2017; Sari, 2017; Sumartini, 2016).

Profile of Math Problem Solving Ability Auditory Learning Style

Jawaban :

Diketahui : - Harga jual = 315 jeruk → Rp. 2.300,- / buah
 200 jeruk → Rp. 2.800,- / buah
 - Untung = Rp. 276.500

ditanya : Harga beli ?

Jawab :

Harga jual = $315 \times 2.300 = 724.500$
 $200 \times 2.800 = 560.000$ +
 1.284.500

Harga beli = $1.284.500 - 276.500 = 1.008.000$
 → Rp. 1.008.000 : 630 = Rp. 1.600

Jadi, harga beli satu buah jeruk Rp. 1.600

Figure 2. S2 Troubleshooting Process

Based on the answers of S2, in checking the validity of the data, the researchers conducted interviews with S2. Below are excerpts of an interview with S2.

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PROFILE OF STUDENTS' MATHEMATIC PROBLEM-SOLVING ABILITY AT CLASS VII SOCIAL ARITHMETIC MATERIALS ASSESSED FROM LEARNING STYLE

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Abstract

Learning style is an activity of thinking, processing, and understanding something that is preferred and has the characteristics of each person. Problem-solving ability is a skill that needs to be possessed in the process of solving mathematical problems. This study aims to describe students' problem-solving abilities on social arithmetic material in terms of learning styles. The research was conducted through a descriptive qualitative research design. The population is all seventh-grade students of MTs Al-Khairiyah, South Jakarta. Sampling using a total sampling technique. Then three students were selected, namely students who scored the highest visual, auditory and kinesthetic learning styles. The instrument uses a learning style questionnaire and a test of problem-solving skills and semi-structured interviews—data analysis techniques with data reduction, exposure, and concluding to explain mathematical problem-solving abilities. The findings of this study are students with the highest scores of visual, auditory, and kinesthetic learning styles can solve social arithmetic problems based on Polya's steps without any significant differences, only from different styles when solving problems.

Keywords: problem-solving ability, learning style

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INTRODUCTION

As technology develops, the focus of mathematics education gradually changes from learning achievement to increasing various abilities (Tan & Ang, 2016; Umam & Kowiyah, 2018). An assessment score indicates learning achievement, but what is more important is the process in learning that seeks to improve abilities, including communication, problem-solving, critical and creative thinking (Sanders, 2016; Umam, 2018). In line with that, NCTM sets five standards for learning mathematics: problem-solving, reasoning, connection, communication, and representation (Dahar, 2011; NCTM, 2000).

Problem-solving skills lead students to think systematically, logically, critically and never give up on problems. So that mathematics is part of a tool to train students to be proficient in solving problems and building thinking processes. In problem-solving, a person performs analysis, prediction, reasoning, evaluation, and reflection (Anderson, 2009; Phonapichat et al., 2014). The school mathematics curriculum views problem-solving as the main activity, so it is contained in the 2013 curriculum (Kurniasih & Sani, 2014; Warli, 2014). Various aspects have been prepared in K 13, which was developed to prepare generations with character. Make the planning, selection of appropriate learning methods are efforts to be made in the training of problem-solving ability; a specification is essential in achieving the purpose of the learning process (Cahyani & Setyawati, 2016;

Commented [MOU1]: Hanya menyajikan kutipan? tidak memberikan narasi pendapat anda sendiri?

Soebagyo, 2018; Wahyudin, 2008). Problem-solving is related to discovery, using logic, inductive and deductive discovery processes, making decisions with a specific purpose (Alexander, 2012; Lakatos, 1976; Polya, 1978; Simon, 1991).

In the learning process, a teacher should have basic knowledge about the learning styles of the students. Gunawan (2007) explains that the student's learning style is how the students do the thinking, process and understanding of the information obtained (Syofyan, 2017; Syukur & Misu, 2014). Each student has a different learning style, so when learning mathematics, there are easy to understand, and some find it difficult to understand. Some students like it when the teacher teaches by writing conveys orally or likes small group learning for discussion, and there are even students who want it when the teacher uses props. This situation shows the diversity of learning styles owned by students. The Neuro-Linguistic Programming expert explained three human learning styles: visual, auditory, and kinesthetic (Lestari et al., 2017; Wikanengsih, 2012). Visual learning style dominates in visual acuity, and it is easier or faster to understand by seeing. The auditory learning style relies more on hearing in understanding and remembering. This learning style likes to talk, discuss or explain. At the same time, the aesthetic learning style is learning by moving, touching or working.

PRISE research in Indonesia released a study that stated that the ability to solve simple math problems was almost the same between new students entering elementary school and those who had graduated from high school (Okenews, 2018). Additionally, research related difficulties of students in solving mathematical problems have been carried out, of them student difficulties in solving the problem of multiple interpretations of the given problem, the lack of prior knowledge, the lack of mathematical literacy (Buschman, 2020; Wang, 2003). In addition, the lack of knowledge and understanding of students when performing arithmetic operations, for students who have low abilities will perform arithmetic operations randomly without knowing the correct procedure (Sutrisno, 2015; Zhang et al., 2014).

The researcher's initial observations to several students at MTs in Jakarta found answers regarding social arithmetic material. Some students in solving problems have not been systematic, but some students problem-solve well and solve problem-solving with Polya's steps. Indicators in problem-solving are understanding the problem, formulating a plan, implementing the plan and checking again.

Based on the previous explanation, by knowing the learning style, the teacher can maximize mathematical learning, especially problem-solving. So, in this research, the profile of students' mathematical solving ability on social arithmetic material will be examined in terms of students' learning styles.

Theoretical review

Learning Style

Someone can see their learning style when they feel comfortable, safe and easy to understand when learning. A person chooses a learning style according to himself in obtaining information and knowledge in the learning process. Learning style is a consistent way, a habit that a person does to reveal information, experiences for thinking, remembering and solving problems in learning (Nasution, 2011; Sundayana, 2018). Learning styles are essential so that the learning process is fun and gets satisfactory results because individuals will feel comfortable carrying out learning activities.

Gunawan said that students who use a dominant learning style in studying, taking tests would get higher scores than students who study not in line with their learning style (Mustafida, 2013; Prianto, 2013). Meanwhile, DePorter and Hernacki stated that the learning style combines students' ways of processing information, absorbing and

Commented [MOU2]: Tidak muncul state of the art dari riset nya apa? Perbedaan riset anda dengan riset sebelumnya dimana dan keunggulan riset anda apa dibandingkan dnegan sbelumnya?

organizing (Mufidah, 2017; Wassahua, 2016). Besides Fleming & Mills, learning style is the tendency of students to use strategies in learning (Minarti, 2013; Seyal & Rahman, 2015).

The opinion of Neuro-Linguistic Programming explains that there are three human learning styles, namely visual, auditory and kinesthetic (Lestari et al., 2017). Visual learning style dominates in visual acuity, and it is easier or faster to understand by seeing. The auditory learning style relies more on hearing in understanding and remembering. This learning style likes to talk, discuss or explain. In contrast, the aesthetic learning style is learning by moving, touching or working.

Problem-solving Ability

The importance of problem-solving in learning mathematics so that students can gain experience from using knowledge and skills in solving complex problems is crucial. Solving math problems involves using prior knowledge to solve problems in new situations (Mulyati, 2016; Yarmayani, 2016). An overview of problem-solving as the primary process when learning mathematics occurs in the classroom (Umam, 2018; Winarti et al., 2019). Problem-solving is a focused thought to determine the solution/solution to a specific problem (Mawaddah & Anisah, 2015). In line with that, Gunantara argues that problem-solving includes the skills or potential of students to solve the issues and apply them in everyday life (Gunantara, 2014).

Polya (1973) states the stages that are passed to solve problems include: 1) Understanding the problem, 2) Planning a strategy, 3) Implementing the plan, and 4) Re-examining (Luluk, 2019; Netriwati, 2016). The ability to understand the problem can be seen by mentioning what is known, asked and the conditions given in a problem. Next, look for the relationship between the information obtained with previous knowledge or experience as evidenced by compiling completion steps. After understanding the problem and developing a plan, then carry out the plan based on the plan that has been prepared. The last step is to re-examine the work results so that it can find results as expected. Each student has differences in carrying out the problem-solving process depending on the level of mathematical reasoning they have (Joko S, 2021). This situation happens because of differences in intelligence, thinking skills, creativity, interests, attitudes and cognitive styles.

METHODS

Types of research

The type of research used is descriptive description to describe students' problem-solving abilities on social arithmetic material in terms of learning styles. Students are first divided into two groups based on visual and auditory learning styles, then given social arithmetic questions containing stories to find out the problem-solving profile of each group. The results of the students' answers were analyzed according to the indicators of problem-solving ability.

Subject Selection

The population in this study were all seventh-grade students at MTs Al-Khairiyah Mampang Prapatan Jakarta 2020/2021. The number of students is 131 consisting of 4 classes, and then the sample selection is the total sampling technique (see table 1). In comparison, the subjects in this study were two students, one student with a visual learning style and one student with an auditory learning style who had the highest score.

Table 1. Sample Demographics

| Category | Sum | |
|------------------------------------|----------|----|
| Gender | Boy | 58 |
| | Girl | 73 |
| Learning Style | Visual | 65 |
| | Auditory | 66 |
| Learn Maths during a pandemic with | Mobile | 94 |
| | Laptop | 37 |

Data Collection Technique

Data were collected through preliminary observations, learning style questionnaires and problem-solving ability tests and structured interviews. The learning style questionnaire was conducted to obtain student data on learning styles. The problem ability test is given to students who have visual and auditory learning styles with the highest scores using questions to three students of class VII-C. From the results of student work, answers to the questions given are obtained. Questions and answers as research data are then analyzed based on problem-solving ability indicators, namely 1) Understanding the problem, 2) Planning, 3) Implementing planning and 4) Re-examining (see table 2). From the results of data analysis, the profile of students' problem-solving abilities is described.

Table 2. Problem Solving Indicators According to Polya (Polya, 1978)

| Indicators | Criteria for Knowledge Construction Activities |
|------------------------|--|
| Understanding Problems | Students can identify problems by showing what is known, asked, and the completeness of the elements needed |
| Devise a Plan | Students can determine the formula or initial method of completion, can conduct investigations for problem-solving |
| Carrying out a Plan | Students carry out the plan by completing the planned steps |
| Looking Back | Students re-examine the results of the completion to ensure the work steps are following the procedure |

Research Instruments

The data obtained are about learning styles and mathematical problem-solving abilities so that they require valid instruments. The researcher is the main instrument, then assisted by three other tools: a learning style questionnaire, a social arithmetic test, and an interview guide. The learning style questionnaire was adopted from Bobby Deporter, Mark Reardon, & Srah Singer-Nourie to determine students' learning styles. The test of mathematical problem-solving ability is a matter of social arithmetic material in-story questions.

Traders bought 630 oranges. Then he sold 315 oranges for Rp. 2.300,-/fruit, another 200 oranges for Rp. 2.800,-/fruit and the rest are not sold because they are rotten. If the trader earns a profit of Rp. 276.500,-, how much is the price to buy one orange!

Research Data Analysis

The data in this study is to classify students' learning styles and problem-solving abilities. The resulting data was then analyzed qualitatively using the stages of reduction, presentation and conclusion drawing to determine the profile of students' mathematical problem-solving skills (Miles, M. B., & Huberman, 1994)

RESULTS & DISCUSSION

Student Learning Style

The results of the learning style questionnaire data can be seen in the table below:

Table 3. Learning Style Questionnaire Results

| Learning Style | Frequency | Percentage |
|----------------|-----------|------------|
| Visual | 67 | 51,1% |
| Auditory | 45 | 34,4% |
| Kinesthetic | 19 | 14,5% |
| Sum | 131 | 100% |

Commented [MOU3]: bentuk tabel sesuaikan dengan tamplet pada jurnal formatif

Based on table 3, from 131 students obtained 67 students (51.1%) with visual learning style, 45 students (34.4%) with auditory learning style, and 19 students (14.5%) with kinesthetic learning style. The results of observations and interviews of researchers with several students who have a visual learning style show that they tend to prefer when the teacher or friends are explaining; besides, they tend to like to argue or tell stories about the material being studied (Mufidah, 2017; Wassahua, 2016).

Profile of Math Problem Solving Ability Visual Learning Style

Diketahui: Pedagang membeli jeruk 630 buah
terjual 315 harga 2.300/buah
terjual 200 harga 2.800/buah
Pedagang memperoleh keuntungan Rp. 276.500.
Ditanya: Harga beli satu buah jeruk?
Jawab:
jumlah jeruk = 630
> harga jual 315 x 2.300 = 724.500
> harga jual 200 x 2.800 = 560.000
total penjualan = 1.284.500
keuntungan = 276.500
maka harga beli = Rp. 1.284.500 - Rp. 276.500 = Rp. 1.008.000
harga per jeruk = Rp. 1.008.000 / 630
= Rp. 1600.

Figure 1. S1 Troubleshooting Process

Based on S1's answer, then to check the validity of S1, interviews were conducted. Below are excerpts of an interview with S1.

- R: When you first saw the question, what did you think? (P01)
S1: The question about social arithmetic in the buying and selling section, Ms. (S101)
R: What do you understand from this question? (P02)
S1: There is a selling price of oranges, of which 315 oranges cost Rp.2300. Another 200 oranges for IDR 2,800. The number of oranges bought by the seller is 630, meaning that there are rotten ones not sold. In addition, the seller's profit is known. What you are looking for is the purchase price of one orange (S102)
R: Okay then, what steps did you take? (P03)
S1: First, I counted the sales of 315 oranges, then the sales of 200 oranges. From there we know the total sales. If you ask the purchase price, then the selling price - profit (S103)
R: Quite detailed in explaining the steps. If you have finished working, do you re-correct the work? (P04)
S1: Of course ma'am, moreover, this number is not pretty hehe (S104)

Based on the results of problem-solving and interviews with S1, it appears that S1 can solve problems well. S1 explains the information from the questions given accurately and adequately, namely known and asked (S102), making plans in solving problems according to procedures (S103) and re-examining the work results (S104). S1 can carry out four stages of problem-solving according to Polya, so S1 is classified as a student with high mathematical problem-solving abilities (Fatmawati & Murtafiah, 2018; Samo, 2017; Sari, 2017; Sumartini, 2016).

Profile of Math Problem Solving Ability Auditory Learning Style

Jawaban :

diketahui : - Harga Jual = 315 Jeruk → Rp. 2.300,- / buah
 100 Jeruk → Rp. 2.800,- / buah

- Untung = Rp. 276.500

ditanya : Harga beli ?

Jawab :

$$\begin{array}{r} \text{Harga Jual} = 315 \times 2.300 = 724.500 \\ 200 \times 2.800 = 560.000 \quad + \\ \hline 1.284.500 \end{array}$$
$$\begin{array}{r} \text{Harga beli} = 1.284.500 - 276.500 = 1.008.000 \\ \rightarrow \text{Rp. } 1.008.000 : 630 = \text{Rp. } 1.600 \end{array}$$

Jadi, harga beli satu buah jeruk Rp. 1.600

Figure 2. S2 Troubleshooting Process

Based on the answers of S2, in checking the validity of the data, the researchers conducted interviews with S2. Below are excerpts of an interview with S2.

- R: When you first saw the question, what did you think? (P01)
S2: Looking for the purchase price of one orange, this is about social arithmetic, ma'am. (S201)
R: What do you understand from this question? (P02)
S2: From the question, it is known that the number of oranges purchased was 600, then 315 were sold for Rp. 2,300/fruit, 200 oranges were sold for Rp. 2,800/fruit. The rest doesn't count as sold because it's rotten. The advantage of the question is already known, so to find the purchase price, use the formula for selling price less profit (S202)
R: What are you planning to do to solve this problem? (P03)
S2: First, calculate the selling price, which consists of 315 oranges and 200 oranges. Then look for the purchase price = selling price - profit (S203)
R: Quite detailed in explaining the steps. If you have finished working, do you re-correct the work? (P04)
S2: Trying to be thorough, but I still corrected the results that have been done, Mrs. (S204)

Based on the results of problem-solving answers and interviews with S2, it appears that S2 can solve problems well. S2 can explain information from the questions appropriately given and accurately, that is, it is known and asked (S202), makes plans in solving problems according to procedures (S203), re-examines the results of work not carried out by S2 (S204). S2 can do the problem-solving stage, according to Polya, so S2 is classified as a student with the category of having good mathematical problem-solving skills (Irianti, 2020; Mairing et al., 2011; Rani & Istiqomah, 2019; Risani & Nuriyatin, 2021).

Profile of Math Problem Solving Ability Kinesthetic Learning Style

Penyelesaian:

Dik:

- Jumlah keseluruhan jeruk = 600 buah
- 315 jeruk dijual sehingga 2300/buah
- = $315 \times 2300 = \text{Rp. } 724.500$
- 200 jeruk dijual sehingga 2800/buah
- = $200 \times 2800 = \text{Rp. } 560.000$
- Keuntungan = Rp. 276.500

Dit:

Barapa harga beli satu buah jeruk?

Jawab:

$$\begin{aligned} \text{harga beli} &= \text{Total dari penjualan} - \text{Keuntungan} \\ &= (\text{Rp. } 724.500 + \text{Rp. } 560.000) - \text{Rp. } 276.500 \\ &= 1.284.500 - 276.500 \\ &= 1.008.000 \end{aligned}$$

harga beli satu jeruk

$$= 1.008.000 : 600 = 1.680$$

Jadi harga beli satu jeruk Rp. 1.680

Figure 3. S3 Troubleshooting Process

Based on the answer S3, then in checking the validity of the researchers conducted interviews with S3. Below are excerpts of an interview with S3.

- R: *When you first saw the question, what did you think? (P01)*
S3: *About Social Arithmetic Mrs. (S301)*
R: *What do you understand from this question? (P02)*
S3: *It is known that the selling price of oranges is different, namely Rp. 2,300/fruit and Rp. 2,800/fruit. In addition, the profit from the sale is known. What is being asked is the purchase price of each orange, Mrs. (S302)*
R: *So, from the information on the questions, what are your plans to solve the problem? (P04)*
S3: *First, calculate the selling price of 315 oranges, than 200 oranges. Then the total sales - profits are then divided by 630 for the price of each fruit. (S304)*
R: *Oh, that's right, if you have finished working on it, will your work be corrected again? Why is something crossed out of the previous answer? (P05)*
S3: *God willing, I always correct ma'am, so why do I cross out something, because at first, I miscalculated ma'am, hehe (S305)*

Based on the results of the work and interviews with doctoral degrees, it can be seen that doctorates understand the problem (S302 & S303) and can plan well (S304). However, in implementing the plan, S3 made an error in determining the interest rate. However, S3 process re-checking can realize a mistake in the calculation so that it looks like there are streaks in the repair process (S305). Errors in carrying out the plan are usually seen from the incompatibility of the mathematical model and completion steps, mastering some concepts and working strategies (Isnaeni et al., 2018; Komarudin, 2016; Nurdiana, 2017). Re-examining needs special attention because the process of re-examining is essential in solving mathematical problems to minimize technical errors, but not a few students feel confused about what to do in the process of re-examining (Irfan, 2017; Kristofora & Sujadi, 2017; Ruswati et al., 2018)

CONCLUSION

From the observations of 3 subjects who have visual, auditory and kinesthetic learning styles with the highest scores, it can be concluded that students with visual learning styles are able to solve social arithmetic problems based on Polya's steps, namely understanding the problem, formulating plans, implementing plans and re-examining. Students who have a good visual learning style have the following characteristics: neat, orderly, thorough and detailed, prioritizing appearance.

Students with auditory learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, making plans, implementing plans and checking again. Students with auditory learning styles are seen reading a little more complicated in the problem-solving process, sometimes turning left and fitting when there is noise.

Students with kinesthetic learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, making plans, implementing plans and checking again. It can be seen that students occasionally tap the table and their feet on the floor as if doing specific movements will provide a sense of comfort to provide stimulation in solving mathematical problems.

There was no significant difference in students' problem solving with visual, auditory and kinesthetic learning styles. However, it can only be seen from the body gestures and attitudes that appear when solving mathematical problems.

Commented [MOU4]: Pembahasan masih kurang tajam. komparasikan apa yang menjadi pembeda kemampuan pemecahan masalah siswa berdasarkan learning style nya.

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An Analysis of Students' Mathematical Problem-Solving Ability at Class VII Social Arithmetic Materials Based on Learning Styles

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An Analysis of Students' Mathematical Problem-Solving Ability at Class VII Social Arithmetic Materials Based on Learning Styles

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Abstract

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Learning style is an activity of thinking, processing, and understanding something that is preferred and has the characteristics of each person. Moreover, problem-solving ability is a skill that needs to be possessed in the process of solving mathematical problems. This study aims to describe students' problem-solving abilities on social arithmetic material in terms of learning styles. The research was conducted through a descriptive qualitative research design. The subject population was all seventh-grade students of MTs Al-Khairiyah, South Jakarta. Sampling was conducted using a total sampling technique. Three students were selected, namely students who scored the highest visual, auditory, and kinesthetic learning styles. The instrument used a learning style questionnaire and a test of problem-solving skills and semi-structured interviews—data analysis techniques with data reduction, exposure, and concluding to explain mathematical problem-solving abilities. The findings of this study were that students with the highest scores of visual, auditory, and kinesthetic learning styles can solve social arithmetic problems based on Polya's steps without any significant differences. They only have different styles when solving problems.

Keywords: problem-solving ability, learning style

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INTRODUCTION

As technology develops, the focus of mathematics education gradually changes from learning achievement to increasing various abilities (Tan & Ang, 2016; Umam & Kowiyah, 2018). An assessment score indicates learning achievement. Nonetheless, the process in learning to seeks improvement in abilities, including communication, problem-solving, critical, and creative thinking is considered more important (Sanders, 2016; Umam, 2018). In line with the view, National Council of Teachers of Mathematics (NCTM) sets five standards for learning mathematics: problem-solving, reasoning, connection, communication, and representation (Dahar, 2011; NCTM, 2000).

Problem-solving skills trigger students to think systematically, logically, critically, and never give up on problems. In this case, mathematics is part of a tool to train students to be proficient in solving problems and building thinking processes. In problem-solving, a person performs analysis, prediction, reasoning, evaluation, and reflection (Anderson, 2009; Phonapichat et al., 2014). Schools' mathematics curriculum views problem-solving as the main activity, as contained in the 2013 curriculum (Kurniasih & Sani, 2014; Warli, 2014). Various aspects have been prepared in K 13, which was developed to prepare generations with characters. Planning and selection of appropriate learning methods are

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efforts to be made in the training of problem-solving ability; a specification that is essential in achieving the purpose of the learning process (Cahyani & Setyawati, 2016; Soebagyo, 2018; Wahyudin, 2008). Problem-solving is related to discovery, using logic, inductive and deductive discovery processes, as well as making decisions with a specific purpose (Alexander, 2012; Lakatos, 1976; Polya, 1978; Simon, 1991).

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In the learning process, a teacher should have basic knowledge about the learning styles of the students. Gunawan (2007) explains that the students' learning style is how the students do the thinking, process, and understanding of the information obtained (Syofyan, 2017; Syukur & Misu, 2014). Each student has a different learning style. In the case of learning mathematics, there are students who find mathematics easy to understand and some find it difficult to understand. Some students like it when the teachers teach by writing, conveying orally or like small group learning for discussion. There are even students who wish when the teacher uses props. This situation shows the diversity of learning styles possessed by students. The Neuro-Linguistic Programming expert explained three human learning styles: visual, auditory, and kinesthetic (Lestari et al., 2017; Wikanengsih, 2012). Visual learning style dominates in visual acuity, and it is easier or faster to understand by seeing. The auditory learning style relies more on hearing in understanding and remembering. This learning style likes to talk, discuss or explain. At the same time, the aesthetic learning style is learning by moving, touching, or working.

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Someone can experience their learning style when they feel comfortable, safe, and easy to understand when learning. A person chooses a learning style according to him/herself in obtaining information and knowledge in the learning process. Learning style is a consistent way, a habit that a person does to reveal information, experiences for thinking, remembering, and solving problems in learning (Nasution, 2011; Sundayana, 2018). Learning styles are essential to make the learning process fun and to get satisfactory results because individuals will feel comfortable carrying out learning activities.

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Gunawan said that students who use a dominant learning style in studying, taking tests would get higher scores than students who study not in accordance with their learning style (Mustafida, 2013; Prianto, 2013). Meanwhile, DePorter and Hernacki stated that the learning style combines students' ways of processing, absorbing, and organizing information, (Mufidah, 2017; Wassahua, 2016). Besides Fleming & Mills, learning style is the tendency of students to use strategies in learning (Minarti, 2013; Seyal & Rahman, 2015).

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The views of Neuro-Linguistic Programming explain that there are three human learning styles, namely visual, auditory and kinesthetic (Lestari et al., 2017). Visual learning style dominates in visual acuity, and it is easier or faster to understand by seeing. The auditory learning style relies more on hearing in understanding and remembering. This learning style likes to talk, discuss or explain. In contrast, the aesthetic learning style is learning by moving, touching, or working.

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PRISE research in Indonesia released a study that stated that the ability to solve simple math problems was almost the same between new students entering elementary school and those who had graduated from high school (Okenews, 2018). Additionally, research related to difficulties of students in solving mathematical problems have been carried out. Among them include student difficulties in solving the problem of multiple interpretations of the given problem, the lack of prior knowledge, and the lack of mathematical literacy (Buschman, 2020; Wang, 2003). In addition, the lack of knowledge and understanding of students when performing arithmetic operations, whereby students who have low abilities will perform arithmetic operations randomly without knowing the correct procedures (Sutrisno, 2015; Zhang et al., 2014).

The importance of problem-solving in learning mathematics to gain experience from using knowledge and skills in solving complex problems is crucial. Solving math

problems involves using prior knowledge to solve new situations (Mulyati, 2016; Yarmayani, 2016). An overview of problem-solving as the primary process when learning mathematics occurs in the classroom (Umam, 2018; Winarti et al., 2019). Problem-solving is a focused thought to determine the solution to a specific problem (Mawaddah & Anisah, 2015). In line with that, Gunantara argues that problem-solving includes the skills or potential of students to solve the problems and apply them in everyday life (Gunantara, 2014).

Polya (1973) explains the stages to solve problems include: 1) Understanding the problem, 2) Planning a strategy, 3) Implementing the plan, and 4) Re-examining (Luluk, 2019; Netriwati, 2016). The ability to understand the problem can be seen by mentioning what is known, asked, and the conditions given in a problem. Afterwards, it is important to see the relationship between the information obtained with previous knowledge or experience as evidenced by completing the steps. After understanding the problem and developing a plan, then the plan is then carried out. The last step is to re-examine the results so that it can find results as expected. Each student has differences in carrying out the problem-solving process depending on the level of mathematical reasoning they have (Joko S, 2021). This situation happens because of differences in intelligence, thinking skills, creativity, interests, attitudes, and cognitive styles.

The researchers' initial observations to several students at MTs in Jakarta found answers regarding social arithmetic materials. In solving problems, some students have not been systematic, some solve the problems well, and some solve with Polya's steps. Indicators in problem-solving are understanding the problem, formulating a plan, implementing the project, and checking again. In the previous research, we found that the four phases of Polya in solving linear story questions, based on student beliefs, have a different level (Soebagyo et al., 2021). It makes it more interesting for us to know in another way.

Based on the previous explanation, by knowing the learning style, the teacher can maximize mathematical learning, especially problem-solving. Therefore, in this research, the profiles of students' mathematical solving ability on social arithmetic material will be examined in terms of students' learning styles.

METHODS

The type of research used is descriptive to describe students' problem-solving abilities on social arithmetic material regarding learning styles. Students were first divided into two groups based on visual and auditory learning styles, then given social arithmetic questions containing stories to find out the problem-solving profile of each group. The results of the students' answers were analyzed according to the indicators of problem-solving ability.

Subject Selection

The population in this study were all seventh-grade students at MTs Al-Khairiyah Mampang Prapatan Jakarta 2020/2021. The number of students was 131 consisting of 4 classes. The sample selection was the total sampling technique (see table 1). In comparison, the subjects in this study were two students, one student with a visual learning style and one student with an auditory learning style who had the highest score.

Table 1. Sample Demographics

| Category | Sum | |
|------------------------------------|----------|----|
| Gender | Boy | 58 |
| | Girl | 73 |
| Learning Style | Visual | 65 |
| | Auditory | 66 |
| Learn Maths during a pandemic with | Mobile | 94 |
| | Laptop | 37 |

Data were collected through preliminary observations, learning style questionnaires and problem-solving ability tests, and structured interviews. The learning style questionnaire was conducted to obtain student data on learning styles. The problem ability test was given to students who have visual and auditory learning styles with the highest scores using questions to three students of class VII-C. From the results of students' work, answers to the questions given were obtained. Questions and answers as research data were then analyzed based on problem-solving ability indicators, namely 1) Understanding the problem, 2) Planning, 3) Implementing planning, and 4) Re-examining (see table 2). From the results of data analysis, the profiles of students' problem-solving abilities were described.

Table 2. Problem Solving Indicators According to Polya (Polya, 1978)

| Indicators | Criteria for Knowledge Construction Activities |
|------------------------|--|
| Understanding Problems | Students can identify problems by showing what is known, asked, and the completeness of the elements needed |
| Devise a Plan | Students can determine the formula or initial method of completion, can conduct investigations for problem-solving |
| Carrying out a Plan | Students carry out the plan by completing the planned steps |
| Looking Back | Students re-examine the results of the completion to ensure the work steps are following the procedure |

The data obtained were about learning styles and mathematical problem-solving abilities which require valid instruments. The researcher was the main instrument, who was assisted by three other tools: a learning style questionnaire, a social arithmetic test, and an interview guide. The learning style questionnaire was adopted from Bobby Deporter, Mark Reardon, & Srah Singer-Nourie to determine students' learning styles. The test of mathematical problem-solving ability is a matter of social arithmetic material in-story questions.

Traders bought 630 oranges. Then he sold 315 oranges for Rp. 2.300,-/fruit, another 200 oranges for Rp. 2.800,-/fruit and the rest are not sold because they are rotten. If the trader earns a profit of Rp. 276.500,-, how much is the price to buy one orange!

The data in this study was to classify students' learning styles and problem-solving abilities. The resulting data was then analyzed qualitatively using the stages of reduction, presentation, and conclusion drawing to determine the profile of students' mathematical problem-solving skills (Miles, M. B., & Huberman, 1994)

RESULTS & DISCUSSION

Results

Student Learning Style

The results of the learning style questionnaire data can be seen in the table below:

Table 3. Learning Style Questionnaire Results

| Learning Style | Frequency | Percentage |
|----------------|-----------|------------|
| Visual | 67 | 51.1% |
| Auditory | 45 | 34.4% |
| Kinesthetic | 19 | 14.5% |
| Sum | 131 | 100% |

S1 Troubleshooting Process with Visual Learning Style

Diketahui: pedagang membeli jeruk 630 buah
 terjual 315 harga 2.300/buah
 terjual 200 harga 2.800/buah
 Pedagang memperoleh keuntungan Rp. 276.500.

Ditanya: Harga beli satu buah jeruk?

Jawab:

$$\begin{aligned} \text{Jumlah Jeruk} &= 630 \\ > \text{harga jual } 315 \times 2.300 &= 724.500 \\ > \text{harga jual } 200 \times 2.800 &= 560.000 \\ \text{total penjualan} &= 1.284.500 \\ \text{keuntungan} &= 276.500 \end{aligned}$$

$$\text{maka harga beli} = \text{Rp. } 1.284.500 - \text{Rp. } 276.500 = \text{Rp. } 1.008.000$$

$$\begin{aligned} \text{harga per jeruk} &= \text{Rp. } 1.008.000 / 630 \\ &= \text{Rp. } 1600 \end{aligned}$$

Figure 1. S1 Troubleshooting Process

S2 Troubleshooting Process with Auditory Learning Style

Jawaban :

diketahui : - Harga Jual = 315 Jeruk \rightarrow Rp. 2.300,- / buah
 200 Jeruk \rightarrow Rp. 2.800,- / buah

- Untung = Rp. 276.500

ditanya : Harga beli ?

Jawab :

$$\begin{array}{r} \text{Harga Jual} = 315 \times 2.300 = 724.500 \\ 200 \times 2800 = 560.000 \quad + \\ \hline 1.284.500 \end{array}$$

Harga beli = $1.284.500 - 276.500 = 1.008.000$
 \rightarrow Rp. 1.008.000 : 630 = Rp. 1.600

Jadi, harga beli satu buah jeruk Rp. 1.600

Figure 2. S2 Troubleshooting Process

S3 Troubleshooting Process with Auditory Learning Style

Penyelesaian :

Dik :

- Jumlah keseluruhan jeruk = 630 buah
- 315 Jeruk dijual seharga 2300/buah
 $= 315 \times 2300 = \text{Rp. } 724.500$
- 200 Jeruk dijual seharga 2800/buah
 $= 200 \times 2800 = \text{Rp. } 560.000$
- Keuntungan = Rp. 276.500

Dit :

Berapa harga beli satu buah jeruk ?

Jawab :

$$\begin{aligned} \text{harga beli} &= \text{Total dari penjualan} - \text{Keuntungan} \\ &= (\text{Rp. } 724.500 + \text{Rp. } 560.000) - \text{Rp. } 276.500 \\ &= 1.284.500 - 276.500 \\ &= 1.008.000 \end{aligned}$$

harga beli satu jeruk
 $= 1.008.000 : 630$
 $= 1.600$

Jadi harga beli satu jeruk Rp. 1.600

Figure 3. S3 Troubleshooting Process

Discussion

Based on Table 3, of 131 students, 67 students (51.1%) have visual learning style, 45 students (34.4%) have auditory learning style, and 19 students (14.5%) have kinesthetic learning style. The results of observations and interviews of researchers with several students who have visual learning styles showed similarities to the Mufidah and Wassahua's research results, discovered states that they tend to prefer when the teacher or friend is explaining; In addition, they tend to like to argue or tell stories about the materials being studied (Mufidah, 2017; Wassahua, 2016).

Profile of Math Problem Solving Ability Visual Learning Style

Based on S1's answer and the validity check, interviews were conducted. Below are excerpts of an interview with S1.

R: *When you first saw the question, what did you think? (P01)*

S1: *The question about social arithmetic in the buying and selling section, Ms. (S101)*

R: *What do you understand from this question? (P02)*

S1: *There is a selling price of oranges, whereby 315 oranges cost IDR 2,300. Another 200 oranges for IDR 2,800. The number of oranges bought by the seller is 630, meaning that rotten ones are not sold. In addition, the seller's profit is known. What you are looking for is the purchase price of one orange (S102)*

R: *Okay then, what steps did you take? (P03)*

S1: *First, I counted the sales of 315 oranges, then the sales of 200 oranges. From there we know the total sales. If you ask the purchase price, then the selling price - profit (S103)*

R: *Quite detailed in explaining the steps. If you have finished working, do you re-correct the work? (P04)*

S1: *Of course ma'am, moreover, this number is not pretty hehe (S104)*

Based on the results of problem-solving and interviews with S1, it appeared that S1 could solve problems well. S1 explained the information from the questions given accurately and adequately, namely known and asked (S102), making plans in solving problems according to procedures (S103), and re-examining the work results (S104). S1 could carry out four stages of problem-solving according to Polya. In this case, S1 can be classified as a student with high mathematical problem-solving abilities (Fatmawati & Murtafiah, 2018; Samo, 2017; Sari, 2017; Sumartini, 2016).

Profile of Math Problem Solving Ability Auditory Learning Style

Based on the answers of S2 and the validity check of the data, the researchers conducted interviews with S2. Below are excerpts of an interview with S2.

R: *When you first saw the question, what did you think? (P01)*

S2: *Looking for the purchase price of one orange, this is about social arithmetic, ma'am. (S201)*

R: *What do you understand from this question? (P02)*

S2: *From the question, it is known that the number of oranges purchased was 600, then 315 were sold for IDR 2,300/fruit, 200 oranges were sold for IDR*

2,800/fruit. The rest doesn't count as sold because it's rotten. The advantage of the question is already known, so to find the purchase price, use the formula for selling price less profit (S202)

R: What are you planning to do to solve this problem? (P03)

S2: First, calculate the selling price, which consists of 315 oranges and 200 oranges. Then look for the purchase price = selling price - profit (S203)

R: Quite detailed in explaining the steps. If you have finished working, do you re-correct the work? (P04)

S2: Trying to be thorough, but I still corrected the results that have been done, Mrs. (S204)

Based on the results of problem-solving answers and interviews with S2, it appeared that S2 could solve the problems well. S2 could explain information from the questions appropriately given and accurately, that is, known and asked (S202), making plans in solving problems according to procedures (S203), and re-examining the results of work that was not carried out by S2 (S204). S2 can do the problem-solving stage, according to Polya. S2 can be classified as a student with good mathematical problem-solving skills (Irianti, 2020; Mairing et al., 2011; Rani & Istiqomah, 2019; Risani & Nuriyatin, 2021).

Profile of Math Problem Solving Ability Kinesthetic Learning Style

Based on the answer S3 and the validity check, the researchers conducted interviews with S3. Below are excerpts of an interview with S3.

R: When you first saw the question, what did you think? (P01)

S3: About Social Arithmetic Mrs. (S301)

R: What do you understand from this question? (P02)

S3: It is known that the selling price of oranges is different, namely IDR 2,300/fruit and IDR 2,800/fruit. In addition, the profit from the sale is known. What is being asked is the purchase price of each orange, Mrs. (S302)

R: So, from the information on the questions, what are your plans to solve the problem? (P04)

S3: First, calculate the selling price of 315 oranges, then 200 oranges. Then the total sales - profits are then divided by 630 for the price of each fruit. (S304)

R: Oh, that's right, if you have finished working on it, will your work be corrected again? Why is something crossed out of the previous answer? (P05)

S3: God willing, I always correct ma'am, so why do I cross out something? Because at first, I miscalculated ma'am, hehe (S305)

Based on the results of the work and interviews with S3, it can be seen that S3 understood the problem (S302 & S303) and could plan well (S304). However, in implementing the plan, S3 made an error in determining the interest rate. Nonetheless, S3's process of re-checking discovered a mistake in the calculation shown by the cross-out answers (S305). Errors in carrying out the plan are usually seen from the incompatibility of the mathematical model, completion steps, mastering some concepts and working strategies (Isnaeni et al., 2018; Komarudin, 2016; Nurdiana, 2017). Re-examining needs special attention because it is essential in solving mathematical problems to minimize technical errors, but few students feel confused about what to do in re-examining (Irfan, 2017; Kristofora & Sujadi, 2017; Ruswati et al., 2018).

CONCLUSION

From the observations of 3 subjects who have visual, auditory, and kinesthetic learning styles with the highest scores, it can be concluded that students with visual learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, formulating plans, implementing plans, and re-examining. Students who have a good visual learning style have the following characteristics: neat, orderly, thorough, and detailed, prioritizing appearance. Students with auditory learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, making plans, implementing plans, and re-checking. Students with auditory learning styles were seen reading a little more complicatedly in the problem-solving process, sometimes easily to be distracted. Students with kinesthetic learning styles can solve social arithmetic problems based on Polya's steps, namely understanding the problem, making plans, implementing plans, and re-checking. Students occasionally tap the table and their feet on the floor as if doing specific movements will provide a sense of comfort to provide stimulation in solving mathematical problems. There was no significant difference in students' problem-solving with visual, auditory, and kinesthetic learning styles. However, it can only be seen from the body gestures and attitudes that appear when solving mathematical problems.

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