The 2nd International Conference on Mathematics Education and Technology (ICOMET) 2023
ISSN 2986-8513 | pp. 195-201 (2023)
Publisher: University of Islam Malang

DIFFICULTY IN SOLVING A SOCIAL ARITHMETIC QUESTION BASED ON SOLO TAXONOMY

Mita Permatasari [1], Sri Hariyani [2*], Retno Marsitin[3]

[1,2,3]Mathematics Education Study Program, Faculty of Sains and Technology, University PGRI Kanjuruhan Malang, Jl. S. Supriadi No. 48, Malang, Indonesia

ABSTRACT

Results observed show that the thoroughness of students in finish question mathematics is low, therefore need one identify difficulties experienced by students. This research is a type of descriptive qualitative research that aims to analyze student difficulties in solving arithmetic problems based on the SOLO Taxonomy. Response students in the finish question grouped using SOLO Taxonomy levels, namely prestructural, unistructural, multistructural, rational, and extended abstract levels. Difficulty on each completion level question analyzed with the use of stage indicators solution Polya includes the understanding stage problem, arranging plan completion, carrying out plan solution, and inspecting return the results obtained. Method data collection in this research used test material arithmetic social and interviews to complete the data. The subjects of this research were class IX students at Sumbermanjing 4th Public Middle School Wetan One Roof. Study This focus solution question student at the extended abstract level. This is because solution question students at the extended abstract level are more complete, so analysis difficulty students more easily explore. Research results with the use of rubric difficulty student shows that difficulty students at the extended abstract level in finish question arithmetic social obtained percentage on stage understand the problem by 7.5%, stage compile plan solution by 12.5%, stage carry out plan solution of 12.5%, and stage inspect results obtained by 15%. Concluded that frequent difficulties experienced by students at the extended abstract level on stage inspection are back. This is because students are not enough to be careful, students are not used to doing questions with procedure solution systematic, students have finished solutions so that forget to inspect return answers, and students are not enough capable allocate duration time solution questions provided in a way maximum.

Keywords: SOLO Taxonomy, analysis difficulty, arithmetic social, stages Polya

1. Introduction

Mathematics has an important role in everyday life, several daily life problems can be solved with mathematical concepts. It is important to introduce mathematics to students so that they can think realistically, coherently, in detail, critically, and creatively (Bhoke, 2020) Mathematics is one of the subjects studied by students from elementary school, middle school, and even university. This is because mathematics is seen as the basis of all knowledge, close to everyday life. Several everyday problems show the role of mathematics in everyday life such as weighing corn harvests, measuring wood for furniture needs, carrying out buying and selling transactions at the market, determining the proportions of ingredients for making cakes, and other number-related activities. At the junior high school level, economic mathematics is taught to students in the form of social arithmetic material. Social arithmetic contains mathematical concepts that are useful in buying and selling transaction activities such as calculating profits and losses, discounts on sales of goods, gross, net, and tare (Mayang Sari et al., 2018). To determine the effectiveness of material achievement, student responses must be measured. One way to measure student responses is the SOLO taxonomy (*structure of Observed Learning Outcomes*).

The SOLO taxonomy groups students' responses when solving mathematics problems

*) Corresponding Author.
E-mail: srihariyani@unikama.ac.id
Phone: +6281332496234

(Azmia & Soro, 2021) The SOLO taxonomy was designed as an evaluation tool for student responses to an assignment. According to Desyana (2020), a student's level of response will differ between one concept and another, and this difference will not exceed the optimal level of cognitive development for his age. Maulidia (2019) states that students' responses to similar tasks vary. One time a student showed a lower level, but at other times he showed higher levels. The SOLO taxonomy or structure of observable learning outcomes is an easy and simple tool to determine the quality of student responses and analyze difficulties. The SOLO taxonomy is appropriate to apply in school learning, this is because the SOLO taxonomy is hierarchical and can bring out students' creative abilities (Rahayu & Kusumo, 2019)The SOLO taxonomy classifies five different and hierarchical levels, namely prestructural, unistructural, multistructural, relational, and *extended abstract* (Fahrudin, 2019). SOLO taxonomic level indicators are shown in Table 1.

Table 1. SOLO Taxonomic Levels

Response Levels	Description
Prestructural	Students do not understand the questions, resulting in an inability to answer the questions.
Unistructural	Students only use one piece of information correctly but the conclusions given are irrelevant.
Multistructural	Students make mistakes in their operations so that the conclusions obtained are irrelevant.
Relational	Students can relate several pieces of information to produce related and relevant conclusions.
Extended abstract	Students can use some information and combine learning experiences so that the conclusions obtained are relevant.

adapted from Wulansari (2020)

Dwidarti, et al. (2019) states that difficulties in mathematics are characterized by not remembering one or more terms of a concept. This shows that students still have difficulty understanding mathematical problems. Difficulties experienced by students in learning mathematics can be estimated from students' mistakes in working on problems, understanding problems, making mathematical models, carrying out computations, and interpreting mathematical answers. The meaning of difficulty analysis in this research is an investigation of the learning difficulties experienced by students in solving social arithmetic material questions at the junior high school level.

Students' difficulties in this research were analyzed using the Polya stages. The indicators for the polya stages according to Midawati (2022) are (a) understanding the problem, (b) preparing a resolution plan, (c) implementing the resolution plan, and (d) re-examining the results obtained. Students' difficulties in solving mathematics problems are influenced by the views of students who consider mathematics subjects to be too difficult. The results of this research on student difficulties are useful information for parents and teachers as a basis for efforts to provide appropriate assistance, so that through the treatment provided, learning objectives can be achieved well and satisfactorily, furthermore the emergence of similar difficulties can be prevented. This research is important to carry out as a reference for research that examines students' difficulties in solving mathematical problems.

2. Research Methods

This research aims to obtain in-depth data and reveal more details about students' difficulties in working on social arithmetic problems based on the SOLO taxonomy. This research approach is a qualitative approach using descriptive qualitative research. The data source in this research is class IX students of SMP Negeri 4 Sumbermanjing Wetan Satu Roof. Research subjects were determined through a social arithmetic material test through categorization using the SOLO taxonomy. The total number of test numbers is 2 questions. The test results are given a score and grouped based on the score using the SOLO Taxonomy categorization level. The level of student grouping based on the SOLO Taxonomy is shown in Table 2 below:

Table 2. SOLO Taxonomy Score Range

Mark	Group
$\mathbf{0}$	Prestructural
$\mathbf{0 < n \leq 25}$	Unistructural
$\mathbf{25 < n \leq 50}$	Multistructural
$\mathbf{50 < n \leq 75}$	Relational
$\mathbf{75 < n \leq 100}$	Extended Abstract

Source: (Ratnayanti, 2021)

The data collection procedure includes a social arithmetic material test which is analyzed using the polya and interview stages. The test is intended to identify the difficulties students experience in solving social arithmetic problems. The test allocation is 2 x 40 minutes. The form of the test is in the form of essay questions. The tests are validated by experts before being given to students. Validation aims to ensure that the test instrument meets the requirements for substance, language, and question weight so that it can be used to measure students' level of difficulty in solving problems. The test results were analyzed using the Polya stages. Indicators of difficulty in solving problems based on Polya stages are shown in Table 3.

Table 3. Indicators of Completion Difficulty Problems Based on Polya

Polya Stages	Difficulty Indicator
Understanding the Problem	a) Students do not write down what they know and what they ask b) Students have difficulty writing completely what they know and what they ask c) Students write down what they know and what is asked completely and correctly
Develop a Resolution Plan	a) Students cannot find a solution to the problem b) Students have difficulty identifying the solution steps and formulas used c) Students have difficulty identifying the solution steps and formulas used d) Students can prepare a solution plan correctly and precisely
Implement the Resolution Plan	a) Students cannot write procedures or steps to solve the problem b) Students find it difficult to carry out solution plans carefully c) Students find it difficult to calculate the steps that have been planned d) Students have difficulty completing the steps correctly
Check again the results obtained	a) Students do not write conclusions b) Students find it difficult to write conclusions, read the questions again, and ask themselves whether the questions have been answered c) Students can write a conclusion by reading the question again and asking themselves whether the question has been answered

Interview techniques are needed to strengthen the data in this research. Interviews were conducted to clarify the subject's solution to social arithmetic material problems. The subjects selected for the interview were students at the *extended abstract level*. The determination of interview subjects is based on systematic consideration of problem-solving created by students. Students at the *extended abstract level* are not only able to understand the material but are also skilled in solving mathematical problems so that research objectives can be achieved.

The data analysis stages in this research are data reduction, data presentation, and conclusion. The overall data is studied and classified based on value scores from the largest value to the smallest value (Septiani, et al., 2020; Azwar, 2019). Data reduction was carried out in three stages, namely: 1) scoring the results of student work, 2) grouping the scores of student work results into five levels of the SOLO taxonomy, namely: prestructural, unistructural, multistructural, relational, and extended abstract, and 3) sorting the results of student *work* in *extended abstract* level and complete the data through semi-structured interviews. Data from student work is presented using the Polya stages, while interview transcript data is presented as complementary information. Conclusions are drawn by combining student work data with interview data so that the difficulties experienced by students can be identified.

3. Results and Discussion

The social arithmetic test was given to 22 students. The results of student work are read, scored, and grouped using SOLO taxonomy levels. The following is Table 4 of test result data based on the SOLO taxonomy.

Table 4. Test Result Data Based on SOLO Taxonomy

No.	SOLO Taxonomy Levels	Subject
1	Unistructural	A-11, A-15
2	Multistructural	A-03,A-04,A-06,A-07,A-08,A-09,A-19
3	Relational	A-17,A-18,A-20,A-10, A-12, A-14
4	*Extended Abstract*	A-01, A-02, A-13, A-05, A-16

Based on Table 3, there are no students at the prestructural level, at the unistructural level there are 2 students, at the multistructural level there are 7 students, at the relational level there are 6 students, and at the *extended abstract level* there are 5 students. The results of student work at the *extended abstract level* were analyzed using the Polya stages and are shown in Table 5.

Table 5. Research Subject Difficulty Data

Subject	Question No	Understanding the Problem	Develop a Resolution Plan	Implement the Resolution Plan	Checking the Results Obtained Again
A-01	1	×	✓	×	✓
	2	×	✓	✓	✓
A-02	1	✓	×	×	✓
	2	✓	✓	✓	✓
A-05	1	×	×	×	✓
	2	×	×	×	✓
A-13	1	✓	×	✓	✓
	2	×	✓	✓	✓
A-16	1	×	×	×	✓
	2	×	×	×	✓

Information:
× = didn't experience any difficulties
✓ = having difficulty

Referring to Table 5, Subject A-13 could not solve question number 1 and Subject A-02 could not solve number 2 well. Furthermore, the results of the two students' work were described using the Polya stages. Figure 1 shows the results of Subject A-13's work.

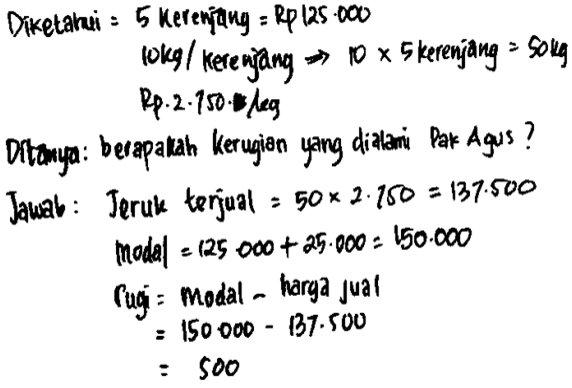

Figure 1. Subject A-13's work results in number 1

Subject A-13 was less thorough in understanding the problem. Subject A-13 can write down what is known, namely 5 baskets = Rp. 125,000. 10 kg/basket becomes 10 x 5 = 50 kg (Subject A-13 should not perform arithmetic operations). Subject A-13 only wrote Rp. 2,750/kg (Subject A-13 should have written additional information for Rp. 2,750/kg. Apart from that, Subject A-13 also did not include transportation costs). Subject A-13 wrote down what was asked, namely how much loss did Mr. Agus suffer? Subject A-13 can make a resolution plan. Subject A-13 wrote that oranges sold = 50 x 2,750 = 137,500. Capital = 125,000 + 25,000 = 150,000. Subject A-13 can carry out the settlement plan, but is not skilled at performing calculation operations. Subject A-13 wrote loss = capital – selling price = 150,000 – 137,500 = 500 (Subject A-13 should have written 12,500. Subject A-13 also did not write a confirmation of the results obtained). Subject A-13 did not re-check the results obtained.

The results of Subject A-13's work at the stage of understanding the problem, the stage of implementing the resolution plan, and the stage of re-examining the results that have been obtained are then clarified using interview data as shown in the following transcript.

Researcher : For question number 1, do you understand the meaning of the question?
A-13 : Got it ma'am
Researcher : Have you written down what you know and what is asked completely?
A-13 : Looks like it's complete, ma'am
Researcher : How is the work process, are there any difficulties in the calculations perhaps?
A-13 : Nothing safe ma'am

Researcher	: After you finished working, did you check your steps and answers again?
A-13	: No ma'am

Based on the results of the interview, students did not write down what they knew completely. Students are not used to details. Sindy (2019) stated that the difficulties experienced by students in understanding mathematical problems were because students were not used to working on story problems systematically (Risma, 2019), could not write down the process in detail, and students were still not careful. Buyung (2021) emphasized that students' failure at the stage of understanding the problem is indicated by students' difficulty in understanding the meaning of the problem.

Students make mistakes when performing arithmetic operations, indicating that students have difficulty applying concepts (Sumarli, 2021). Students are also not careful in carrying out calculations (Rohmah, 2019). Errors can also be caused by students' inability to formulate mathematical sentences (Enlisia, 2020). Students not checking again is a representation that students are not skilled in problem solving, students are also in a hurry to end a problem solution. This means that students ignore the truth of the final results obtained.

The results of Subject A-02's work on question number 2 are shown in Figure 2.

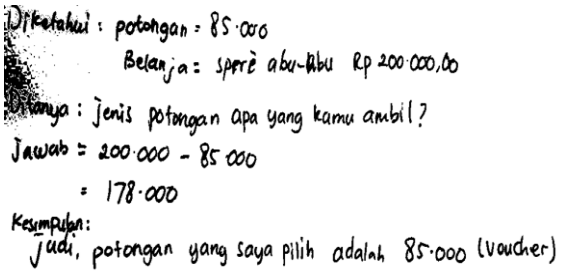

Figure 2. Results of Subject A-02's work on Question Number 1

Subject A-02 wrote down what he knew, namely deduction = 85,000. Shopping = gray bed sheets Rp. 200,000 (Subject A-02 should write down the price of blankets, vouchers, and discounts). Subject A-02 wrote what type of deduction did you take? Subject A-02 wrote the answer 200,000 – 85,000 = 178,000 (Subject A-02 should write down the total purchases with vouchers and the total purchases with discounts, then compare the two total purchases and determine the cheapest total purchases). The results of Subject A-02's work were clarified using interview data as written in the following transcript.

Researcher	: For question number 2, have you written down what you know and what is asked completely, do you understand the meaning of the question?
A-02	: a lot ma'am, because I don't understand the meaning of the problem
Researcher	: How do you formulate a strategy to solve question number 2, are there any difficulties?
A-02	: I'm confused, ma'am, how to write it, I don't understand, so I'll answer straight away
Researcher	: are you sure about your conclusions? write this?
A-02	: I'm not sure ma'am
Researcher	: Do you usually check your answers again?
A-02	: I'll check ma'am, but if I can't do it from the start, I'll just have to look

Based on the results of the interview, Subject A-02 had difficulty understanding the meaning of the questions. This has an impact on the way Subject A-02 solves problems. The reasons for the conclusions are not presented logically. Subject A-02 also did not review the results obtained. Purnamasari (2019) stated that students' difficulties when re-checking the answers they obtained were caused by students' inability to re-check, students were unable to utilize their processing time well, and students were lazy to re-check answers. According to Safitri (2019), students have difficulty evaluating answers because they are not used to re-examining the results obtained.

4. Conclusions

Subjects at the *extended abstract level* have difficulty understanding the problem. The subject does not write completely what is known and what is asked. At the stage of preparing a solution plan, students are less skilled in working on word problems so they have difficulty determining the correct mathematical concept. At the stage of implementing the solution plan, students are less able to write mathematical sentences. At the re-checking stage, almost all students did not re-check the answers they had obtained.

The difficulties experienced by students are due to not understanding the meaning of the questions, not being able to remember the concepts well, not being careful in writing down answers, students being confused about how to re-check the results they have obtained, students not being used to carrying out the problem-solving process systematically and being lazy about re-checking answers. which is obtained. Thus, the best advice for teachers is to train students with varied mathematics questions from the easiest questions to the most difficult questions according to the students' abilities.

5. Acknowledgments (Optional)

I would like to express my gratitude to Mrs. Sri Menganti, M.Pd. (math teacher SMP Negeri 4 Sumbermanjing Wetan satu Atap) for their guidance, academic encouragement, and friendly critique.

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