Mathematical Writing Profile of High Social Arithmetic Ability Student in Solving Social Arithmetic Problems

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Abstract. In solving problems, students need to communicate their ideas. One of the media is writing in written media. Social arithmetic is one of mathematics subject that close to daily live activities. Students’ understanding about social arithmetic and how students communicate their ideas in solving social arithmetic problems can be seen in their mathematical writing. This study aimed to describe how student with high social arithmetic ability mathematical writing in solving social arithmetic problems based on the use of precise mathematical language, explanation of the process, reasoning about the process to produce the right solution, connections between abstract mathematical procedures and the context of the problem. The analysis indicate that student clearly used accurate math vocabulary to communicate ideas, clearly provides the mathematical steps used to solve the problem, clearly described the reasoning used to solved the problem which includes connections between the numbers used in the strategy and the problem context, and then the final answer was clearly explained in the context of the problems. Through student mathematical writing, reader (teacher) will know that student understand the problem and the subject and also can clearly communicate their ideas.

1. Introduction

Learning mathematics is more than solving a set of problems or replicating teacher explanations. It is building a strategy for solving problems, applying various approaches, looking at whether the approach used leads to right solutions, and checking whether the solutions were acceptable [1]. In mathematics learning, students should be able to express their mathematical ideas. One of the media for students is their mathematics idea which is writing in written media. Writing activities in learning mathematics is called writing mathematics, it is a combination of mathematics and writing [2]. There is a writing activity in solving mathematical problems, such as when students write the steps of completion and the explanation while they are solving mathematics problems. The result of writing mathematics is a mathematical writing that consists of a visual language, symbols, or pictures to communicate mathematical ideas. Mathematical writing may also be referred to as a written description of the problem-solving process [3]. Not all types of mathematics problems can produce a written description of the process of completion or mathematical writing. To produce mathematical writing, the questions should use a question word that directs students to express their opinions, as well as explain their ideas.
Produce mathematical writing and the ability to learn in general is connected, to learn new mathematical content, to improve math problem solving, and to add knowledge-related processes [4] [5]. Student mathematical writing can also be used by teachers to understand students' understanding and misunderstanding [4] [1].

Arithmetic social is close to daily live activities, such as buying and selling activities. This term is introduced in mathematics learning since 7th grade. The problem relates to this term, is usually presented in word problem. In solving social arithmetic world problems, students have to build models or represent the problems to form appropriate calculation processes to obtain the right solution [6].

Students understanding about social arithmetic and how students communicate their ideas in solving social arithmetic problems can be seen in their mathematical writing. Based on discussion above, the researcher is eager to search and investigate how students mathematical writing in solving the problem of social arithmetic.

The writing of mathematics in solving the problem of social arithmetic is written words of visual languages, symbols, or pictures to communicate the mathematics ideas in solving stories related to the economic world. Mathematical writing can also be referred to as a written description of the problem-solving process, which is the writing that reveals how students communicate mathematical ideas, how the students representation in solving mathematical problems, and how students justify the strategies used in solving problems. There were four important aspects in mathematical writing. Those are the use of precise mathematical language, explanation of the solution process, reasoning why the solution process produced the correct answer, connections between abstract mathematical procedures and the context of the problem [7] [8][9].

2. Method
This descriptive research with a qualitative approach was designed to obtain information and explore the things that affect the incidence experienced deeply by the research subjects. This study aims to describe how students mathematical writing when communicating their ideas in solving the problem of social arithmetic.

In this research, student with high arithmetic ability was chosen from 27 students from the same environment and the level of school as research subject. The research subject was selected based on social arithmetic ability test scores. Student with score of more than 80 are categorized as student with social arithmetic ability. Furthermore, students were given the task of writing mathematics for further description of how students' mathematical writing in solving social arithmetic problems. The research subjects were interviewed to get additional information about students' mathematical writing. All instruments that used in this research were validated by expert lecturers and piloted to several students before being given to students. The research data was collected by time triangulation technique. Therefore, subjects who have been selected were given the task of writing mathematics and an interview for several times in different time until it is obtained valid data.

3. Result and discussion
After the second triangulation, the researcher had obtained valid data. It is seen when students show consistent answers. The results of the task of writing mathematics I and II can be seen in Figures 1 and 2.
3.1. The use of precise mathematical language

The use of precise mathematical language in students’ mathematical writing can be discovered by these three indicators.

- Using mathematics language in solving problem
- Using good and correct Indonesians rules
- Use appropriate symbols or notations

While doing first writing mathematics task, students use the math language in solving the problem clearly, employ the Indonesian rules quite well and correctly and use the right symbols/notations. Similarly, while doing second writing mathematics task, students use the language of mathematics in
solving the problem clearly, use the Indonesian rule quite well and correctly and use the right symbols/notations.

Based on data triangulation on how they use mathematics language and its accuracy in student mathematical writing, it seen that student was consistent in the use of math language. So that, the data of the use of mathematical language and accuracy in the mathematical writing of students was valid. Thus, the researcher can conclude that:

- Student with high social arithmetic skills clearly use mathematical language in solving problems in their mathematical writing.
- Students with high social arithmetic skills use Indonesian rules well and correctly.
- Students with high social arithmetic skills use appropriate symbols or notations.

3.2. Explanation of the solution process

To find out how the explanation of the solution process, the indicator that must be met was "write down the explanation steps of the problem solving process". While doing first writing mathematics task, student wrote down the explanation of the steps of the completion process into the problem solving strategy. However, there is still some left information. Similarly, while doing second writing mathematics task, student wrote a description of the steps of the completion process into the settlement strategy.

Based on data triangulation on how to explain the steps of the problem solving process on the student mathematical writing, it appears that student was consistent in explaining the steps of the problem solving process. So that the data was valid. Thus, the researcher can conclude that students with high social arithmetic skills write down the explanation of the steps of the settlement process into the settlement strategy quite clearly in their mathematical writing.

3.3. Reasoning why the solution process produced the correct answer

Write down the reasons for the selection of completion measures was the indicator to find out how the reason for selecting the completion steps used to produce the correct solution.

Students wrote down the reasons for choosing clear and confident resolution steps while working on first writing mathematics task. She declared that the settlement that she used in accordance with what she had learned and produced the right answer. Similarly, while doing second writing mathematics task, students write down the reasons for the election of the completion steps clearly and confidently. She declared that the settlement step she used was complete in accordance with what had been learned and produced the correct answer.

Based on data triangulation on why the reason for the selection of completion steps from the problem solving process on the students mathematical writing, it appears that the students was consistent in explaining the steps of writing down the reasons for the selection of the settlement measures. Thus, it can be said that the data of the reasons for the selection of completion steps of the problem solving process on the student's mathematical writing is valid. Thus, the researcher can conclude that students with high social arithmetic capability write down the reasons for choosing clear and confident resolution steps.

3.4. Connections between abstract mathematical procedures and the context of the problem

To find out how the relationship between the mathematical procedure used and the context of the question, “write an explanation of the relationship between the mathematical procedure used and the context of the question” was employed as an indicator.

While working on the first writing mathematics, students wrote an explanation of the relationship between the mathematical procedures used with the problem context quite clearly. She wrote that the settlement step used was the actual and learned way. Likewise while working on the second writing mathematics task, students wrote an explanation of the relationship between the mathematical procedures used with the context of the problem quite clearly. She wrote that the settlement step used was the actual way, done in sequence, using information from the problem, and based on the knowledge that she learned.
Based on the data triangulation on connections between abstract mathematical procedures and the context of the problem on the students’ mathematical writing, it appears that students was consistent in explaining the relationship between the mathematical procedures used and the context of the questions. Thus, the researcher can conclude that students with high social arithmetic skills write an explanation of the relationship between the mathematical procedures used with the context of the question quite clearly.

4. Conclusion
The student who has high social arithmetic ability clearly used accurate math vocabulary to communicate ideas, clearly provided the mathematical steps used to solved the problem, clearly described the reasoning used to solve the problem that includes connections between the numbers used in the strategy and the problem context, and then the final answer was clearly explained in the context of the problems.

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