



ANALYSIS OF MATHEMATICAL CONNECTION ABILITY WHEN SOLVED PROBLEM IN 7th Grade SMPN 9 BURU

Rusmin Madia¹, Nining Holimombo²
^{1,2}Institut Agama Islam Negeri Ambon

maminrusmin@iainambon.ac.id

Abstract

This research was conducted with the aim of knowing the ability of students' mathematical connections to the solution of contextual problems of social arithmetic materials in 7th grade SMPN 9 Buru. This type of research is qualitative research prioritizing process deepening over results, researchers as the main instrument and supporting instruments (tests and interviews), put forward field research that requires researchers to be in the context of research. Data analysis techniques are reduction, presentation, and conclusion drawing. The results showed that students' mathematical connection ability in solving contextual problems in social arithmetic materials in 7th grade SMPN 9 Buru, namely students meet indicators of mathematical connection ability according to NCTM (National Council of Teachers of Mathematics), namely; Recognizing and utilizing the relationships between ideas in mathematics, students are able to complete test questions by writing down what is known, asked answered, writing the right mathematical model and correct answers; Understanding ideas in mathematics are interconnected and underlying with each other to produce a coherent wholeness, students are able to answer problems using mathematical notations such as subtraction, addition and multiplication, and calculate properly and correctly; And knowing and using mathematics in contexts outside mathematics, students are able to associate mathematical concepts with everyday life, such as economics related to the problem of profit and loss in trading.

Keywords: Mathematical Connection Ability; Contextual; Social Arithmetic.

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INTRODUCTION

Mathematical connection ability is one that students should have. According to (NCTM, 2000), "mathematical connections in the rich interplay among mathematical topics, in contexts that relate mathematics to other subjects, and in their own interests and experience". Students' mathematical connection ability, there are three indicators that need to be achieved by students, namely 1) connections between topics in mathematics; 2) mathematical connections in other fields of science; 3) the connection of mathematics with everyday life (Jahring, 2020). At every level of basic education, both in elementary, middle, and high



schools, the target of mathematics learning should develop students' ability to think mathematically.

The development of this ability is very necessary so that students better understand the concepts learned and can apply them in various contexts of daily life. In this regard, one of the abilities that must be possessed by students in order to be able to develop their ability to think mathematically is the ability of mathematical connection (Hani Juita Sari, 2020).

Mathematical connection ability is one of the high-level abilities that learners should have. These abilities include the ability to connect between topics in mathematics, connect mathematical topics with other fields of science, and connect mathematics with everyday life. If students can relate mathematical ideas then their understanding will become deeper and last longer. They can see the mathematical relationships of mutual influence between mathematical topics, in contexts that link mathematics with other subjects, as well as in their own interests and experiences (Jahring, 2020).

The purpose of the mathematical connection itself is to make students able to see mathematics as a science that is not separate so that students can identify problems and describe the results using mathematical material, understand mathematical concepts to understand mathematical concepts to be studied, and use thinking in making models to solve problems in other disciplines (Shinta Permatasari, et. all, 2020)

Mistakes in doing problems are natural things to happen to students who are studying, but mistakes should be minimized. Lerner in Mulyono Abdurahman, posits that there are some mistakes that students often make, namely not understanding the use of symbols, place values, counting, decreased completion that is not precise, writing that is not clear so that it is difficult to read.

Based on the observations and initial interviews of researchers with mathematics teachers on October 11, 2017 at SMPN 9 Buru, it was obtained information that the learning that occurred in SMPN 9 Buru, students were less able to answer math problems when they were connected to the real world of students,



and with questions in the form of story problems require students to be able to solve problems but realita in the field provides information that not a few SMPN 9 Buru students are less able to understand the concepts in the field social arithmetic material.

The purpose of this study is to find out the ability of students' mathematical connections in solving contextual problems in social arithmetic materials in class VIID SMP Negeri 9 Buru. The expected benefits of this study are; theoretically enrich the treasures of science and can practically be considered by teachers in carrying out teaching and learning activities.

METHOD

This research is descriptive qualitative, revealing the meaning of the subject's point of view naturally. Researchers are the main/key instruments in research (Sugiono, 2021). This research was conducted from February to March 2018 at SMPN 9 Buru. The subjects in this study were students of class VII D SMPN 9 Buru.

The process of taking the subject with purposive sampling technique, namely the process of taking the subject by using the specified criteria, namely the results of student tests. From a total of 34 students, 6 were taken as subjects in this study, but to simplify this research, the researcher decided to take 2 students who met the mathematical connection indicators used in this study. The research instrument consisted of the researcher himself as the main instrument and the supporting instrument (tests, and interviews). The technique of collecting data was by conducting tests on the subject and selecting those who met the indicators of mathematical connection ability after which they were interviewed and 2 people were selected. The data analysis technique in this study used three stages, namely; data reduction, data presentation, and conclusion drawing.

RESULTS AND DISCUSSION



Mathematical connection ability is one of the most important thinking skills in learning mathematics. By having mathematical connection skills, a student can analyze and solve various problems related to mathematics, connect mathematics with various concepts and other sciences and can apply the mathematical knowledge that has been studied previously in everyday life in the problem solving process.

Based on the results of research conducted on class VIID SMPN 9 Buru, it is known that the mathematical connection abilities of these students are different. The results showed that the connection ability possessed by students affected the students' ability to solve contextual problems/questions.

Because, the better the connection ability possessed by a student, the better the student's ability in the problem solving process. In this study, indicators of mathematical connection ability refer to the NCTM (National Council of Teacher of Mathematics), namely (a) Recognizing and utilizing relationships between ideas in mathematics; (b) Understanding how ideas in mathematics relate to and underlie one another to produce a coherent whole; (c) Recognizing and applying mathematics in contexts outside of mathematics . The results of this study, it can be explained that the two students who became informants at the time of the interview

The two students selected to be informants according to the test results in this study were Amirna Talessy (AT) further referred to as the subject of AT and Juli Yanti Umasugi (JU) hereinafter referred to as the subject of JU. The two subjects were chosen because they had excellent category test results of social arithmetic materials.

There are three indicators used for the analysis of mathematical connection skills, namely (a) Knowing and utilizing the connections between ideas in mathematics; (b) Understanding ideas on mathematical concepts is interrelated and underlying between one concept and another concept that can lead to a coherent wholeness; (c) Recognize and apply mathematical concepts in contexts outside of mathematics. The following is a description of each of these indicators to the work of at and JU subjects.



The following is a description of the results of the work of the AT subject in solving contextual problems in social arithmetic materials

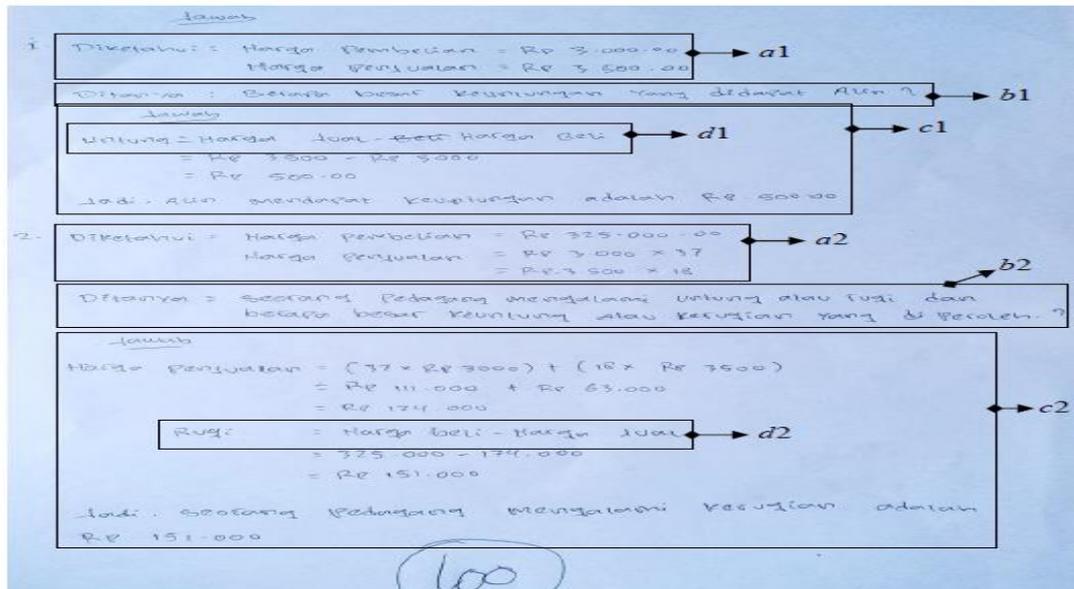


Figure 1. Work Results AT subjects recognize the use of relationships between ideas in mathematics (Indicator 1).

The exploration of the results of the work of the AT subject above is able to recognize ideas by writing down what is known and asked in the questions. AT work on answer number 1, where in writing what is known in point a1 is the Purchase Price = Rp. 3,000 and Selling Price = Rp. 3,500 and writes what is asked as in point b1: how much profit did you get?. Furthermore, the subject of AT writing is answered as in point c1 and begins to use the social arithmetic mathematical model as in point d1 namely Profit = Selling Price - Purchase Price to solve the problem and answer profit = Rp. 3,500 - Rp. 3,000 = Rp. 500, so that it is obtained the profit is Rp.500. While in answer number 2, it appears that the subject of AT wrote Known (see point a2): Purchase Price = Rp.325,000 and Sales Price = Rp.3,000 x 37 and Rp.3,500 x 18.

Next, the subject AT wrote what was asked as in point b2 ie: A trader has made a profit or loss and how much profit or loss did he get?. Then the subject of AT wrote an answer (see point c2) by detailing each sale with a price, namely: 37



x Rp. 3,000 and 18 x Rp. 3.500 then he wrote a mathematical model of social arithmetic as shown in d2, namely: Loss = Purchase Price – Selling Price, he also solved the second question by answering = Rp. 325,000 – Rp. 174,000 = Rp. 151,000. So, a trader suffers a loss of Rp. 151,000. from the answers, it was concluded that the subject of AT met the first indicator, namely; "recognize and" exploit the relationships between ideas in mathematics". Reinforced by the statement of the subject of AT when interviewed as follows: "We often do this way of working when we study mathematics or other science subjects, such as physics. That's why I work on questions like that so that they can be finished quickly."The statement of the subject of AT in the excerpt of the interview above shows the ability of the subject of AT in solving the problem by writing what he said.

$$\begin{aligned} \text{Harga Penjualan} &= (37 \times \text{Rp } 3000) + (18 \times \text{Rp } 3500) \\ &= \text{Rp } 111.000 + \text{Rp } 63.000 \\ &= \text{Rp } 174.000 \end{aligned}$$
$$\begin{aligned} \text{Rugi} &= \text{Harga beli} - \text{Harga jual} \\ &= 325.000 - 174.000 \\ &= \text{Rp } 151.000 \end{aligned}$$

Figure 2. AT Subject's ability to understand how mathematical ideas relate and underlie one another to produce a coherent whole (Indicator 2).

AT subjects are also able to understand (figure 4.2), connect mathematical ideas well, where in answer number 2 the AT subject is able to determine the right steps so that they can determine the selling price as in point a, namely: 37 x Rp.3,000 = Rp. .111,000 and 18 x Rp.3,500 = Rp.63,000, then he uses summation notation (see point b) to find the total selling price, which is Rp.111,000 + Rp.63,000 = Rp.174,000. In solving problem number 2, the subject of AT also relates the total price sales with a loss model or formula in social arithmetic. The following is the result of an interview with the subject of AT regarding his ability to relate the total selling price to the loss formula: "In order to get this answer, I



looked and paid attention to the question of mother, because in the question it was known that the selling price of the goods was not the same, there were 37 of them being sold at different prices. the price is Rp. 3,000 while the 18 are sold for Rp. 3,500, so each must be calculated the price individually, then I add the two together so that I can know what the total selling price is. If I already know the total selling price then I compare which one is bigger, if the purchase price is greater than the selling price, it means a loss, then I continue to calculate how much the loss is, and it turns out that the loss is Rp. 151,000.”

AT subjects are able to relate one concept to another. Thus, it can be concluded that the subject of AT has fulfilled the second indicator, namely understanding how ideas in mathematics are interconnected and underlie each other to produce a coherent whole. In addition, the AT subject can present ideas by writing because the selling price is greater than the purchase price, the trader experiences a profit of Rp. 500 (answer number 1), then in answer number 2, the AT subject suffers a loss because the purchase price is greater than the selling price. It can be concluded that the subject of AT has met the third indicator.

JU subjects in solving contextual problems on social arithmetic material

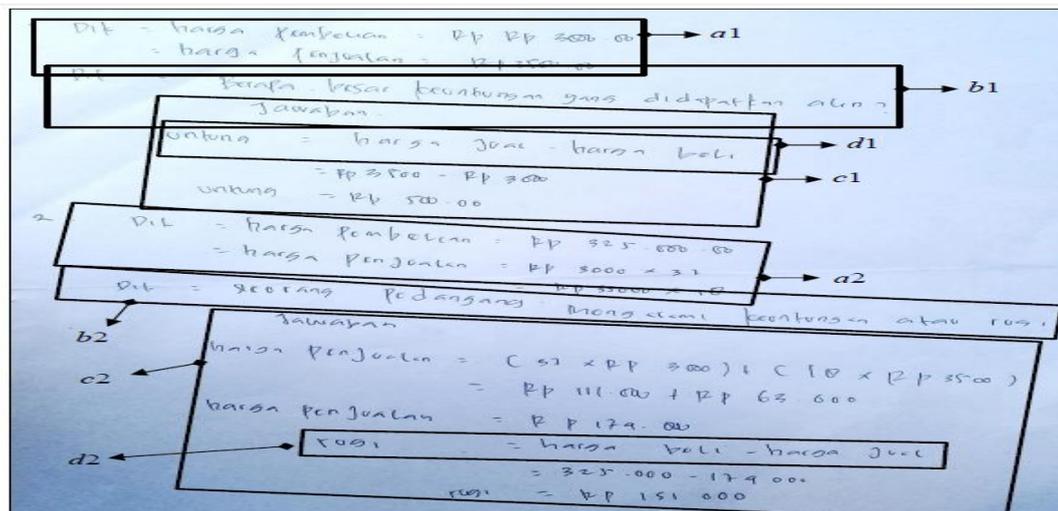


Figure 3. Work Results JU subjects recognize the use of relationships between ideas in mathematics (Indicator 1).



The results of the work of the JU subject in Figure 4.3 above, there is almost no difference between the AT subject and the JU subject, where in answer number 1 and answer number 2, the subject of JU has also known the idea by writing what is known and asked when answering questions and the subject of JU uses the idea by writing these ideas to create a mathematical model used in answering questions. In answer number 1, the subject of JU can write that what is known as in point a1 is the Purchase Price = Rp. 3,000 and the Selling Price = Rp. 3,500. Next, the subject of JU wrote what was asked (see point b1): how much profit did you get?. Then the subject of JU answered by writing Answer as in point c1 and in answering the question the subject of JU used the mathematical model of social arithmetic as in point d1, namely: Profit = Selling Price - Purchase Price, he also solved the question by answering = Rp.3,500 - Rp. .3,000 = Rp.500. So, Alin's profit is Rp. 500. It's just that, in solving this first problem, the JU subject did not write a conclusion like the AT subject did. However, the results of the calculations of the two students are the same and correct.

Then in answer number 2, the subject of JU starts solving the problem again by writing It is known as in point a2, namely: Purchase Price = Rp.325,000 and Sales Price = Rp.3,000 x 37 and Rp.3,500 x 18. Furthermore, the subject of JU also writes what asked at point b2 namely: A trader experienced a profit or loss and how much profit or loss was obtained?. Then the subject of JU wrote an answer (see point c2) by detailing each sale with a price, namely: 37 x Rp. 3,000 and 18 x Rp. 3,500, then he also wrote a mathematical model of social arithmetic as in point d2, namely: Loss = Purchase Price – Selling price, he also solved the second question by answering = Rp. 325,000 – Rp. 174,000 = Rp. 151,000. However, the JU subject did not write a brief conclusion as did the AT subject.

The following is a statement of the subject of JU when interviewed to find out how he was able to solve the problem: "If this way of working is often exemplified by our teachers at this school, usually when we do homework, the way it works should be written like that." Interview quotes JU subjects are able to work on social arithmetic problems because they are always directed by the mathematics



teachers at the school in doing their homework, so that students are familiar with the procedure for solving these structured math problems. Based on the results of the work of JU subjects in the first and second answers, the first indicator of mathematical connection ability was met, namely recognizing and utilizing the relationships between ideas in mathematics.

Meanwhile, for the third indicator of mathematical connection ability according to NCTM, namely recognizing and applying mathematics in contexts outside of mathematics, it can be explained that the material taken in this study is related to contextual problems of social arithmetic, thus if students are able to solve problems correctly, then indirectly he has been able to recognize and apply mathematics in contexts outside of mathematics, such as economics related to the problem of profit and loss in trading. Based on a study of the results of the work of the AT subject, both answers to number 1 and number 2 are known that the subject of AT is also able to use terms outside of mathematics and mathematical notation itself well. In solving AT subject questions, you can use terms such as purchase price, selling price, and notations, operation signs (\times), (+), (-), (=), numbers, formulas and profit. In addition, the AT subject can present ideas by writing because the selling price is greater than the purchase price, the trader experiences a profit of Rp. 500 (answer number 1), then in answer number 2, the AT subject suffers a loss because the purchase price is greater than the selling price.

Then the second indicator, related to students' mathematical connection abilities in solving contextual problems on social arithmetic material, can be seen in Figure 4 below



Dik = 30 orang pedangar = Rp 35000 x 18
 Jawaban: Mengalami keuntungan atau rugi.

harga penjualan = $(37 \times \text{Rp } 3000) + (18 \times \text{Rp } 3500)$
 $= \text{Rp } 111.000 + \text{Rp } 63.000$
 $= \text{Rp } 174.000$

harga beli = harga beli - harga jual
 $= 325.000 - 174.000$
 rugi = Rp 151.000

Figure 4. The ability of JU Subjects to understand mathematical ideas are interrelated and underlie each other to obtain a coherent whole (Indicator 2)

Figure 4 shows that the subject of JU is also able to understand, relate mathematical ideas well, where in the picture above the subject of JU is able to determine the right steps so that they can determine the selling price as in point a, namely $37 \times \text{Rp}.3,000 = \text{Rp}. 111,000$ and $18 \times \text{Rp}.3,500 = \text{Rp}.63,000$, then he uses summation notation to find out the total selling price, as in point b, which is $\text{Rp}.111,000 + \text{Rp}.63,000 = \text{Rp}.174,000$ and so on. In solving problem number 2, the subject of JU also relates the total selling price with a model or formula for loss in social arithmetic to find out how much loss a seller receives. To determine the ability of the subject of JU in connecting the total selling price with the loss formula, it can be seen in the results of the interview with the subject of JU as follows: "It is said that there are 60 oranges that are sold at different prices. There were 37 fruits that were sold at a price of Rp. 3,000 and 18 of them were sold at a price of Rp. 3,500, while the rest of the oranges were rotten, so the seller automatically suffered a loss. So I had to multiply the 37 fruit by Rp. 3,000 and multiply the 18 by Rp. 3,500, after that I just added it up to find out how much money I received from selling oranges. If I get the total selling price of the oranges, then I will compare it with the capital money used to buy the oranges, if the capital money is more from the money from selling oranges, the orange seller suffers a loss." From the results of the work of the JU subject above, it can be stated that the JU subject is able to connect one concept or idea with other concepts or ideas. It can be concluded that the subject of JU has fulfilled the second indicator, namely understanding how ideas



in mathematics are interconnected and underlie each other to produce a coherent whole.

Furthermore, on the third indicator of mathematical connection ability according to NCTM, namely recognizing and applying mathematics in contexts outside of mathematics, it can be explained that the subject of JU is able to relate mathematical concepts to concepts outside of mathematics such as economics related to the problem of profit and loss in trading, even when interviewing the subject of JU he also used other terms such as modal. Based on a study of the work of the subject of JU. In solving JU subject questions, you can use terms such as purchase price (capital), selling price, and notations, operating signs (\times), (+), (-), (=), numbers, formulas and also profit. In addition, the subject of JU can present ideas by writing because the selling price is greater than the purchase price, the trader experiences a profit of Rp. 500 (answer number 1), then in answer number 2, the subject of JU suffers a loss because the purchase price is greater than the selling price. . It can be seen that in the answers to number one and two, the subject of JU has been able to conclude the profits and losses obtained by traders. Thus, the AT subject has met the third indicator of students' mathematical connection abilities, namely recognizing and applying mathematics in contexts outside of mathematics.

DISCUSSION

Based on the results of research conducted in 7th grade SMPN 9 Buru, it is known that the mathematical connection abilities of these students are different. The results of the study indicate that the connection abilities possessed by students affect students' ability to solve problems/questions contextual questions. Because, the better the connection ability possessed by a student, the better the student's ability in the problem solving process. In this study, indicators of mathematical connection ability refer to the NCTM, namely (a) Recognizing and utilizing relationships between ideas in mathematics; (b) Understanding how ideas in mathematics relate to and underlie one another to produce a coherent whole; (c) Recognizing and applying mathematics in contexts outside of mathematics (Ika Silvia Anggareni, 2004). The results of this study, it can be explained that the two



students who became informants at the time of the interview at the research location, were students who had excellent mathematical connection skills, because they could fulfill the three indicators of the NCTM above. In the first indicator, namely the indicator of recognizing and utilizing the relationships between ideas in mathematics, students are able to solve the essay test questions in a structured/regular way or procedure and their results are also correct. According to them, the problem solving method, starting from writing down what is known, asked and answered, is a method of problem solving that has often been taught by teachers at SMP Negeri 9 Buru, both mathematics teachers and other science teachers such as physics teachers. Mathematical connections can assist students in learning mathematical concepts, both existing concepts (learned) with new concepts. This can help students to formulate their own knowledge both in answering questions or in the context of the real world.

Furthermore, on the second indicator, that the results of the analysis of the student answer sheets show that this indicator is also able to be fulfilled by students. Students are able to understand, relate mathematical ideas well, where the answer sheet shows they are able to determine the right steps so that they can determine the selling price and purchase price, then use addition and subtraction notation to find out the total selling price and losses obtained. It can be seen that students are able relate the total sales price with a loss model or formula in social arithmetic to find out how much loss a seller receives. Thus, it can be concluded that students have fulfilled the second indicator, namely understanding how ideas in mathematics are interconnected and underlie each other to produce a coherent whole. This is in line with the opinion of Ni'mah et al that the ability of students to connect between subjects in mathematics and connect mathematics with real life in the student's environment is very important for students because the linkage can help students understand the topics in mathematics and students can make mathematical models of problems in everyday life. This provides knowledge to students regarding the benefits of mathematics (Anis Fitriatun Ni'mah, 2017).



Then the third indicator, which is recognizing and applying mathematics in contexts outside of mathematics, shows that students are able to relate mathematical concepts to concepts outside of mathematics such as economics such as the concept of profit and loss in trading, even when interviewing the subject of JU he also use other terms such as capital. From a study of the work of the JU subject, both answers to number 1 and number 2 are known that students have been able to use terms outside of mathematics and mathematical notation itself well.

Based on these facts, it can be stated that in the process of solving contextual problems, it is very important for students to have mathematical connection skills, so that they can help in the problem solving process. The ability of mathematical connections is needed by students in studying several mathematical topics that are interrelated with each other. Without mathematical connection skills, students will have difficulty learning mathematics.

CONCLUSION

Students' mathematical connection ability in solving contextual problems on social arithmetic material in class VIID of SMPN 9 Buru fulfills three indicators of mathematical connection ability according to NCTM, namely: Recognizing and utilizing the relationships between ideas in mathematics, students are able to solve test questions by writing down what is known, being asked and answered, writing the correct mathematical model and the correct answer; Understanding how ideas in mathematics are interconnected and underlie each other to produce a coherent whole, students are able to answer questions using mathematical notations such as subtraction, addition and multiplication, and calculate properly and correctly; and Recognizing and applying mathematics in contexts outside of mathematics, students are able to relate mathematical concepts to everyday life, such as economics related to the problems of profit and loss in trading. Although there are differences in answers between AT and JU subjects, they always get the same solution.

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