How do indonesian sixth grader students make sense of directproportion: a closer look at student with mathematics anxiety

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Abstract. This study aims to explore how Indonesian students make sense direct proportion concepts according to their level of mathematics anxiety. This research tried to uncover the meaning of a phenomenon for students who are involved. In represents the findings, this research emphasized on seeing through the eyes of students being studied. Fifty-six sixth grader students were asked to complete the CAMS instrument. After completing Indonesian version of Children's Anxiety in Math Scale (CAMS), three female students’ mathematics anxiety levels were created (high, medium, and low). High anxiety student tends to fail in doing an understanding. Student used additive relationships, response without reasons, or use numbers, operations, or strategies randomly in solving the given problems. Medium anxiety student tends to connect the given information listed in the problem with the concepts that she has already had. Student used qualitative comparison, use rate as a unit, and response without reasons in solving the given problems. Low anxiety student connected the given information listed in the problem with the concepts that she has already had. Student used use ratio as a unit, make qualitative comparison, use cross-product rule, and use symbols, commonly algebraic symbols in representing proportions with full understanding of its relationships.

1. Introduction
The concepts of proportion are fundamental to mathematics [1]. Although students have learned the concepts of proportion through their formal education or by using their experiences, students’ lack of understanding about proportion sometimes happens in their learning process. Students are confused whether to use direct or inverse proportion in solving the given problems. Consequently, students may feel afraid and nervous when attending mathematics class or doing some task related to proportion. This may lead to the emergence of students’ anxiety about mathematics.

Students’ anxiety of mathematics is one of the most crucial problems faced by students in their learning process. Mathematics anxiety is a condition that involves feelings of tension and anxiety interfering with the manipulation of numbers and the solving of mathematical problems [2]. Students with high-level of anxiety usually could not think logically. Halele [3] stated that mathematics anxiety has been found to have the potential to decrease the efficiency of students’ working memory. Students failed in showing their relational understanding since mathematics anxiety often occurs as the result of instrumental learning because an understanding of the material is not obtained [4]. Mathematics anxiety also impedes the learning of mathematics and hinders conceptual understanding of mathematical concepts [5].

Recently, several instruments are used and produced to measure mathematics anxiety and attitude for their studies. Among those instruments, 22-item Mathematics Anxiety Scale for Children (MASC), 14-item Mathematics Anxiety Survey (MAXS), and 26-item Suinn Mathematics Anxiety Rating Scale, Elementary Form (MARS-E) are three main instruments are developed to be used for elementary student level [6]. Since those three main scales were adapted from mathematics anxiety scale for adult, some researchers tried to create other instruments that are specifically designed for elementary school level. One of them is 16-item Children’s Anxiety in Math Scale (CAMS) that designed by Jameson [6]. Children responded by using a facial images scale with five expressions ranging from very anxious (scored as a 5) to not at all anxious (scored as a 1). Scores are summed,
with higher scored representing higher levels of mathematics anxiety. In other words, the high CAMS score attained by students indicate the higher level of anxiety in attending mathematics lesson or in doing some tasks related to mathematics.

Some relationships between understanding and mathematics anxiety are found in many studies. Hamza and Helal [7] stated that students’ prior negative mathematics experience results in a lack of understanding of mathematics. Jaggersnath [5] believed that low understanding of mathematics replaces mathematical prowess with fear of mathematics which when left unchecked, morphs into anxiety about mathematics and doing mathematics, while McAnallen [8] emphasizes that memorization without understanding is one reason that some students on her study did not understand algebra and experienced anxiety. Norwood [9] also stated that too much emphasis on mathematics through drilling without understanding contributes to feelings of anxiety toward mathematics. In other words, students’ lack of understanding of certain mathematical concepts becomes the major problem of the emergence of mathematics anxiety. Mathematics needs to be taught for understanding such that mathematics anxiety will decrease. Other relevant studies also found that mathematics learning emphasizing on students’ understanding could decrease the students’ mathematics anxiety level. One of them is found by Vacc (cited in [10]). Vacc believes that a personal and process-orientated teaching method that emphasizes understanding rather than drilling and practice reduces mathematics anxiety. In other words, when students are able to show their relational understanding, it is not impossible that their anxiety in mathematics will reduce.

2. Literature review

2.1. Mathematics anxiety
The term “mathematics anxiety” does not have a unique description. It has been described using various definitions by many researchers. Mathematics anxiety is described by Aarnos and Perkkila [11] as negative affective responses to mathematics. Ashcraft and Moore [12] refer to it as “a person’s negative affective reaction to situations involving numbers, math, and mathematics calculations”, while Tobias and Weissbrod [13] says it as “a feeling of panic, resulting in helplessness, paralysis, and mental disorganization in some people when they are asked to solve a mathematics problem”. One of the most commonly used definitions of mathematics anxiety is the one that was given by Richardson and Suinn [2].

The study of mathematics anxiety has progressed since the creation of the Mathematics Anxiety Rating Scale (MARS) by Richardson and Suinn in 1972. This survey allows researchers to examine the level of mathematics anxiety that the student feels. This initial research tool reproduced many others, namely Abbreviated Math Anxiety Scale (AMAS), MARS-Revised (MARS-R), Mathematics Anxiety Scale (MAS), Shortened MARS (s-MARS), MARS-Adolescents (MARS-A), Mathematics Anxiety Scale for Children (MACS), 12-item Mathematics Anxiety Scale, MARS-Elementary (MARS-E), Math Anxiety Questionnaire (MAQ), Mathematics Anxiety Survey (MAXS), Pictorial Test for Early Signs of Math Anxiety, Scale for Early Mathematics Anxiety (SEMA), and Child Math Anxiety Questionnaire (CMAQ) [14].

2.2. Children’s Anxiety in Math Scale (CAMS)
CAMS is initially designed by Jameson [6]. Jameson claims that although the three main scales for elementary student level (MASC, MAXS, and MARS-E) have strong psychometric properties, there are also weaknesses, such as design for upper elementary, dated, and all use Likert scale (summated rating scale), which are inappropriate for elementary student level.

Jameson classified 16 items in CAMS into three dimensions, namely General Math Anxiety (GMA), Math Performance Anxiety (MPA), and Math Error Anxiety (MEA). GMA items are used to explore students’ anxiety that occurs before doing task related to mathematics, such as “When I think about math, I feel …?” (no. 2 item). MPA items are used to explore students’ anxiety that happen when teacher give them problems to be solved, such as “When my teacher says that he or she is going to give me a math problem on the blackboard, I feel …?” (no. 11 item) or when they are in a process to figure out the given problems, such as “If I have to add up numbers on the blackboard in front of the class, I feel …?” (no. 10 item). MEA items are used to explore students’ anxiety that happens when they make mistakes, such as “When I make a mistake in math, I feel …?” (no. 15 item) or when they
believe they will fail to answer the problems, such as “When I am working on math problems that are difficult and make me think hard, I feel ...?” (no. 13 item).

2.3. Students’ understanding

One of the most widely accepted ideas within the mathematics education in community is that students should understand mathematics [15]. Understanding a certain concept does not mean students can solve the given problems without knowing the reason behind their answers. Skemp [16] believed that understanding something could be obtained when students can assimilate it into an appropriate students’ scheme. While there are many definitions of understanding, this research tends to use the definition proposed by Hiebert & Carpenter [15]. Understanding in mathematics is making connection between mathematical ideas, facts, or procedures to be more structured representation. The similar idea with Hiebert & Carpenter in defining the understanding is proposed by Barmby, Harries, Higgins, & Suggate [17]. They define understanding as the resulting network of representations associated to mathematical concepts. In other words, to understand mathematics is to make connections between mental representations of mathematical concepts.

Since the process of understanding happens in student’s mind, it is impossible for any educators to observe the process of understanding. The one that can be used to look at the process of understanding is by identifying the result of understanding, such as agreement with experts, ability to see deeper characteristics of a concept, to look for specific information in a situation more quickly, to represent situations, and to envision a situation by using mental models [18]. One of the ways in measuring understanding is by considering three indicators proposed by Nizar [19], namely verbal communication, representation of students’ thinking, and the problem solved. First is verbal communication. Understanding can be observed when students can provide a good argument behind their answers or students can answer “how” and “why” rather than problems that are limited to memory only. Second is the representation of their thinking. In order representing students’ understanding, some representations are needed since graphical and symbolic languages can be used as a window on children's understandings. Third is the problem solved. Learning should be started by understanding and ended by checking whether or not the problem solved is adjusted with the designed strategies.

2.4. Direct proportion

A proportion is the statement that two ratios are equal in the sense both convey the same relationship [20]. In other words, when two ratios are equal, it can be said that they are in the same proportion. It is also common to use the proportion term for some specific relations such as direct and inverse proportion. Direct proportion between two quantities occurs when their quantitative changes occur uniformly [1]. In mathematical notation, direct proportion occurs when given four variables $a$, $b$, $c$, and $d$ ($a \neq 0$, $b \neq 0$, $c \neq 0$, $d \neq 0$), then $\frac{a}{b} = \frac{c}{d}$.

2.5. Proportional reasoning

Reasoning is the process of considering all the factors to build a rational conclusion (Kaylan as cited in [21]). Among types of reasoning, proportional reasoning has a significant position in learning mathematics. In defining proportional reasoning, some researchers always put understanding or proportion as the main part of proportional reasoning definition [21, 22, 23, 24].

Several strategies could emerge during the learning process of the concepts of proportion. Ben-Chaim et al. [1] classified it into intuitive, additive, division by ratio, finding the unit, and determining the part from the whole strategy, while Valverde and Castro [25] named four categories, namely incomplete/illlogical, qualitative, additive, and proportional. The more hierarchical arrangement of students’ strategies in solving proportion problems is the one proposed by Langrall & Swafford [20] and Lamon [24]. Langrall & Swafford classified it into non-proportional, informal, quantitative, and formal proportional reasoning, while Lamon classified it as avoiding, visual or additive, and pattern building, preproportional reasoning, qualitative proportional reasoning, and quantitative proportional reasoning.

Among those classifications of students’ strategies proposed by Ben-Chaim et. al. [1], Valverde and Castro [25], Langrall & Swafford [20], and Lamon [24], researcher tends to use Langrall & Swafford’s terminologies in classifying the levels of strategies which is used to solve proportion
problems and combines Langrall & Swafford’s and Lamon’s explanation in characterizing each level of characteristics.

| Strategy                    | Characteristics                                                                 |
|-----------------------------|---------------------------------------------------------------------------------|
| Non-proportional reasoning  | • Use numbers, operations, or strategies randomly                                 |
|                             | • Unable to link the two measures                                                |
|                             | • No serious interaction with problem                                            |
|                             | • Do trial and error                                                             |
|                             | • Response without reasons                                                       |
|                             | • Purely visual judgements                                                       |
|                             | • Use additive relationships                                                     |
|                             | • Use of oral or written patterns without understanding numerical relationships   |
| Informal reasoning          | • Make qualitative comparison                                                    |
|                             | • Use intuitive                                                                  |
|                             | • Use sense-making activities (pictures, charts, modeling, or manipulating)      |
|                             | • Use some multiplicative relationships                                          |
| Qualitative reasoning       | • Use scalar factor or table                                                      |
|                             | • Use equivalent fractions                                                       |
|                             | • Use ratio as a unit                                                             |
|                             | • Use multiplicative relationships                                               |
|                             | • Understand some numerical relationships                                        |
| Formal reasoning            | • Use cross-product rule                                                          |
|                             | • Use algebraic symbols to represent proportions with full understanding of       |
|                             |   functional and scalar relationships                                            |

2.6. Types of proportion problem

In elementary school level, Lamon [24] identifies four types of semantic problem that are typically organized by a proportion. The first type is the well-chunked measures problem. This type involves the comparison of two extensive measures, resulting in an intensive measure (or rate). The example of problem of this type is “The student is shown a page from a driver’s log book, recording total mileage at various intervals on a long trip. After 2, 5, 7, and 8 hours of driving, distance traveled was recorded as 130 miles, 325 miles, 445 miles, and 510 miles, respectively. Was this truck driver traveling at a constant speed through the trip?”. The second type is part-part-whole problem. In this type of problem, the extensive measure (cardinality) of a single subset of a whole is given in terms of the cardinalities of two or more sub-subsets which is composed. The example of problem of this type is “The student is shown pictures of two egg cartons, one containing a dozen eggs (8 white eggs and 4 brown eggs) and the other containing 1½ dozen eggs (10 white eggs and 8 brown eggs). Which carton contains more brown eggs?”. The third type is associated sets problem. Problems involve two elements that sometimes its relationship is unknown or unclear unless their relationship is defined within the problem situation, such as balloons and rupiahs or people and pizza. The example of this type is “The student is shown a picture of 7 girls with 3 pizzas and 3 boys with 1 pizza. Who gets more pizza, the girls or the boys?”. The fourth type is stretchers and shrinkers problem. This problem expresses a relationship between two continuous quantities, such as height, length, width, or circumference, and involve either enlarging/stretching or reducing/shrinking. The example of this type is “The student is shown two rectangles. The height of the first is labeled “6 feet” and its width is labeled “8 feet”. The height of the second rectangle is marked “?” and its width is labeled “12 feet”. These rectangles are the same shape, but one is larger than the other. Explain how you would find the height of the larger rectangle”. Besides the Lamon’s problem types, other researchers also formulate the general types of proportional reasoning problems. Ben-Chaim et al. (cited in [26]) outlined it as comparison of two
parts of a whole, rate or density problems, and scaling problems, while Ilany, Keret, and Ben-Chaim [27] formulated three main categories of proportional reasoning problems: rate and density, ratio, and scaling. Having drawn the Lamon’s four semantic problem types and proportional reasoning problem types proposed by Ben-Chaim et. al. and Ilany et. al., researcher tends to classify the proportion problems into three types, namely comparison, rate & density, and scaling. Reasoning is the process of considering all the factors to build a rational conclusion (Kaylan as cited in [21]). Among types of reasoning, proportional reasoning has a significant position in learning mathematics. In defining proportional reasoning, some researchers always put understanding or proportion as the main part of proportional reasoning definition [21, 22, 23, 24].

3. Method
This research was explorative research with qualitative approach. This research is conducted based on four objectives that emphasize on describing students’ understanding about the concepts of proportion based on their level of mathematics anxiety. This research tried to uncover the meaning of a phenomenon for students who are involved. In represents the findings, this research emphasized on seeing through the eyes of students being studied. Fifty-six sixth grader students were asked to complete the CAMS instrument. CAMS test was given to students in Indonesian version of CAMS. The CAMS scores of each student are summed and sorted in descending order. After classifying the level of mathematics anxiety, researcher selects one student from each level as the research subject. Since gender and age had to be controlled to avoid the bias of the result of the research, researcher chose female students with similar age. In this research, researchers aimed to explore more about the student’s understanding among female students that have been proven have higher level of anxiety in mathematics. In determining the similar age, researcher considers the teacher’s suggestion to choose 12-years old student. Since one of the ways to explore student’s understanding is through student’s oral explanations in interview, mute or deaf student should be eliminated. If there were more than one student in each level of mathematics anxiety remains, researcher selected student who has the highest score for high anxiety, the closest score to the average score in medium anxiety, and the lowest score for low anxiety. The chosen research subject was coded as HA, MA, and LA respectively for high, medium, and low mathematics anxiety.

Two problems were used to explore students’ understanding about direct proportion. In choosing the problems, researcher considers the Langrall & Swafford’s suggestion in using proportion problems that are proposed by Lamon’s. The researcher also considers mathematics teachers’ suggestion to use the problems in national examination for elementary school. Therefore, researcher chooses one problem proposed by Lamon and does the adaptation of the chosen problems to accommodate the teacher suggestion. The remaining chosen problem is collected from the national examination. Those two problems adapted to fulfill the material, construction, and language validity.

Table 2: Result of Validation for Problems of Test of Direct Proportion

| Code | Problems |
|------|----------|
| P1   | Six chocolate bars will be distributed eventually among 10 girls and one chocolate bar will be distributed eventually among 5 boys. Who will get more chocolate, the girls or the boys? |
| P2   | Alfarizy buys 8 pencils in a store whose price is IDR 40,000.00. At the same store, Daffa buys 20 pencils which has the same price with the one bought by Alfarizy. How many rupiahs that should be paid by Daffa? |

The data gathered this research were analyzed by using Miles & Huberman [28] procedures. Those procedures are data reduction, data display, and conclusion drawing and verification. Moreover, in order to determine the quality of the conclusion, data triangulation is also used.
4. Results and discussion

4.1. Profile of high anxiety student

Subject HA could identify the given information listed in problem P1 and P2. In presenting her identification about the given information, she rephrased the information into her own sentences. Between two problems, she wrote the given information once on her worksheet (S1P2.03), while for another problem she could explain what was happening on her mind by explaining it orally (S1P1.02 and S1P1.03). Similar with the way she presented her idea in identifying the given information, she also presented the main question of the problem by writing it on her worksheet (S1P2.03) or through interview (S1P1.04).

In figuring out problem P1, although subject HA presented the correct answer for the problem, she did not deliver the reason behind her answer. It was correct that when she stated 6 chocolates is more than one chocolate. At this point, she made a connection between the given information with the concept of comparing two numbers that has already learned in the previous grades. She believed that since 6 is more than 1, then 6 chocolates are also more than 1 chocolate (S1P1.06). The one that out of her consideration is that the 6 chocolates will be given among 10 girls and one chocolate will be given to 5 boys. Instead of comparing the ratio of chocolate received by each girl and boy, she directly compared the number of chocolates listed in the problem. According to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as make qualitative comparison, which characterized an informal reasoning. In figuring out problem P2, subject HA presented the correct answer of the problem. Although she did not present the correct answer, she realized that she made a mistake in doing the calculation (S1P2.09). She knew that Rp 40,000.00 is the cost to buy 8 pencils (S1P2.02). The problem was that she did not make connection between the given information with the concepts of ratio that she had in her mind. Instead of finding the unit price of a pencil by dividing 40,000 with 8, she directly multiplied 40,000 by 20 to find the money to be spent to buy 20 pencils. According to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as use numbers, operations, or strategies randomly, which characterized a non-proportional reasoning.

Transcription 1.1

RP1.01 : Can you explain to me about the problem?
S1P1.01 : It is about chocolate.
RP1.02 : Can you mention some information written on the given problem?
S1P1.02 : Yes. There are 10 girls and 5 boys will receive chocolate.
RP1.03 : Do they receive the same number of chocolate?
S1P1.03 : No. The girls will receive 6 chocolates and the boys will receive one chocolate.
RP1.04 : So, what is the question?
S1P1.04 : Which one will get more chocolate, girls or boys?
RP1.05 : OK. What should you do?
S1P1.05 : Girl will receive more chocolate.
RP1.06 : Why?
S1P1.06 : 6 chocolate is more than one chocolate. So, girls receive more chocolate.
RP1.07 : Have you read the problem carefully?
S1P1.07 : Yes.
RP1.08 : Are you sure about your answer?
S1P1.08 : I think so.

Transcription 1.2

RP2.01 : Have you read the problem carefully?
S1P2.01 : Yes, Bu.
RP2.02 : What information that you found after reading the problem?
S1P2.02 : The price of 8 pencils is Rp 40.000,00.
RP2.03 : And?
S1P2.03 : The price of 20 pencils is …
RP2.04 : Is that the question?
S1P2.04 : Yes.
RP2.05  : How you can find the price of 20 pencils?
S1P2.05  : Multiply 20 by 40,000.
RP2.06  : Why should be multiplied by 40,000?
S1P2.06  : Because it is written on the problem. The price is Rp 40,000.00.
RP2.07  : Then?
S1P2.07  : I just need to multiply 20 by 40,000.
RP2.08  : So, the answer is …
S1P2.08  : Rp 800,000.00
RP2.09  : But, you wrote Rp 80,000.00 on your sheet.
S1P2.09  : I have made a mistake. It should be Rp 800,000.00.
RP2.10  : Are you sure about your answer?
S1P2.10  : Yes.

In general, subject HA used a non-proportional and informal reasoning in figuring out direct proportion problems. It can be seen when subject HA solved the given problems by using use numbers, operations, or strategies randomly or make qualitative comparison strategies. According to Lamon’s classification of proportional reasoning [24], HA used both non-constructive and constructive strategies to figure out direct proportion problems.

4.2. Profile of medium anxiety student
Subject MA could identify the given information listed in problem P1 and P2. Although she did not write the given information on her worksheet, she could explain what was happening on her mind in identifying the given information of the problems by explaining it orally (S2P1.01, S2P1.02, S2P2.02, S2P2.03). Similar to the way she presented her idea in identifying the given information, she also presented the main question of the problems through interview (S2P1.03, S2P2.04).

In figuring out problem P1, subject MA presented the correct answer for the problem. She knew that there are 6 chocolates to be given to 10 girls. For that reason, she divided 6 by 10 to have ratio 3 : 5 for girl. The similar way also used to find 1 : 5 as the ratio of chocolate received by boy. She made a connection between those ratios with the concept of fractions. In her mind, 3 : 5 could be understood as each girl will have 3 parts if the chocolate bar is divided by 5 parts (S2P1.07) and 1 : 5 as each boy will get a part chocolate bar if the chocolate is divided by 5 parts. At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as use ratio as unit, which characterized a qualitative reasoning. She also made a connection between the ratios and parts of chocolate that received by girl and boy with the concept of comparing two fractions. It could be seen when she stated that girl received 3 parts and boy received 1 part (S2P1.10) and finally concluded that girl have more chocolates (S2P1.09). At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as make qualitative comparison, which characterized an informal reasoning.

In figuring out problem P2, subject MA presented the correct answer for the problem. She knew that the price of 8 pencils is Rp 40,000.00. She also knew that it should be found first the price of one pencil before finding the money to be spent to buy 20 pencils. In finding the unit price of pencil, she made a connection with the concept of division. It could be seen when she stated that 40,000 should be divided 8 to find the unit price of the pencil, that is Rp 1,500.00 (S2P2.06). At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as use ratio as unit, which characterized a qualitative reasoning. She also made a connection between finding the price of 20 pencils by using its unit price with the concepts of multiplication. In doing that, she multiplied 5,000 by 20 to have 100,000. At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as use ratio as a unit, which characterized a qualitative reasoning. In order to make it clear, she also emphasized her answer by stating Daffa spends more rupiahs to buy 20 pencils (S2P2.08). At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as make qualitative comparison, which characterized an informal reasoning.
Transcription 2.1
S2P1.03 : I have to choose which one will get more chocolate.
RP1.04 : OK. What will you do next?
S2P1.04 : Finding the number of chocolate received by girl and boy.
RP1.05 : Have you find it?
S2P1.05 : Yes.
(Pointing on her answer)
RP1.06 : What do you mean about this?
(Pointing on student’s answer)
S2P1.06 : There are 6 chocolate to be given to 10 girls. So, 6/10 = 3/5 = 3:5.
RP1.07 : Meaning?
S2P1.07 : (Thinking) Each girl will have 3 parts if the chocolate bar is divided by 5 parts.
RP1.08 : OK. How about the boy?
S2P1.08 : Each boy will get a part chocolate bar if the chocolate is divided by 5 parts, too.
RP1.09 : So, what is your answer then?
S2P1.09 : Girl will have more chocolate
RP1.10 : Why?
S2P1.10 : Because girl receive 3 parts and boy received 1 part.
RP1.11 : Are you sure about your answer?
S2P1.11 : Yes.

Transcription 2.2
RP2.01 : Have you read the problem carefully?
S2P2.01 : Yes, Bu.
RP2.02 : What is happening in that problem?
S2P2.02 : Buying the similar pencils.
RP2.03 : How many pencils?
S2P2.03 : Alfarizy buys 8 pencils and Daffa buys 20 pencils.
RP2.04 : So, what is the question?
S2P2.04 : Finding how many rupiahs to be spent by Daffa.
RP2.05 : What will you do next?
S2P2.05 : The price of one pencil is Rp 5,000.00.
RP2.06 : Where does the 5,000 come from?
S2P2.06 : 40,000 : 8. I did the calculation in another paper.
RP2.07 : Can you tell me about this?
(Pointing on students’ answer)
Why you multiplied 5,000 by 20?
S2P2.07 : Because alfarizy buys 20 pencils.
RP2.08 : Meaning?
S2P2.08 : Each pencil costing Rp 5,000.00. Therefore, Daffa spends more rupiahs to buy 20 pencils. The cost is Rp 100,000.00.
RP2.09 : So, the answer of the problem is Rp 100,000.00. Are you sure?
S2P2.09 : Yes.

In general, subject MA used informal and qualitative reasonings in figuring out direct proportion problems. It can be seen when subject MA solved the given problems by make qualitative comparison and use ratio as a unit. According to Lamon’s classification of proportional reasoning [24], subject MA used constructive strategies to figure out direct proportion problems.
4.3. Profile of low anxiety student
Subject LA could identify the given information listed in problem P1 and P2. Between two problems, she wrote the given information once on her worksheet (S3P2.02), while for another problem she could explain what was happening by explaining it orally (S3P1.01). Similar with the way she presented her idea in identifying the given information, she also presented the main question of the problem by writing it on her worksheet (S3P2.02) or through interview (S3P1.01).

In figuring out problem P1, subject LA presented the correct answer of the problem. She knew that there are 6 chocolates to be given to 10 girls and one chocolate to be given to 5 boys. For that reason, she performed her understanding by connecting it with the division operation in finding the ratio of chocolate received by each girl and boy. She divided 6 by 10 to have 0.6 for girl. The similar way also used to find 0.2 for boy. At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as use ratio as a unit, which characterized a qualitative reasoning. She also made a connection between those decimals with the concept of comparing two decimals. She stated that she just needed to compare 0.6 with 0.2 (S3P1.07) and decided 0.6 is more than 0.2. By considering the order, 0.6 is more than 0.2, she concluded that the chocolate received by girl also more than the one that received by boy (S3P1.08). At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in solving this problem could be classified as make qualitative comparison, which characterized an informal reasoning.

In figuring out problem P2, subject LA presented the correct answer for the problem. She knew that the price of 8 pencils is Rp 40,000.00. She also knew that it should be found the cost for 20 pencils. For that reason, she decided to suppose the price to be found as \(x\) in order to make it easier to be multiplied (S3P2.05, S3P2.06). At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as use of algebraic symbols to represent proportion, which characterized a formal reasoning. She also made a connection between the given information with the concept of equivalent fractions. It could be seen when subject LA stated that 8/20 should be the same with 40,000/\(x\) since the ratio of number of pencils is the same with the ratio of rupiah to spend those pencils. At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring this problem could be classified as scalar relationships, which characterized a formal reasoning. She also found the value of \(x\) by multiplying 8 with \(x\) and 40,000 with 20. It means that she made a connection the one that she must do, with the concept of cross-product rule. At this point, according to Langrall & Swafford [20] and Lamon [24], the way she used in figuring out this problem could be classified as cross-product rule, which characterized a formal reasoning.

Transcription 3.1
RP1.01 : Can you explain to me about the problem?
S3P1.01 : There are 6 chocolate bars to be given to 10 girls and a chocolate bar to be given to 5 boys.
RP1.02 : And What should you do?
S3P1.02 : I have to choose which one will receive more chocolates.
RP1.03 : Is that the question?
S3P1.03 : Yes.
RP1.04 : Can you explain to me how to solve the problem?
S3P1.04 : I have to divide 6 by 10 and 1 by 5.
(\textit{Pointing on her answer})

RP1.05 : Why?
S3P1.05 : To find how many chocolate received by girl and boy and decide who will receive more chocolates.
RP1.06 : How to do that?
S3P1.06 : For girl, 6 divided by 10 to have 0.6 and for boy, 1 divided by 5 to have 0.2.
RP1.07 : What will you do with 0.6 and 0.2?
S3P1.07 : I just compare them. 0.6 is more than 0.2.
RP1.08 : Meaning?
S3P1.08 : the chocolate received by girl is more that the one received by boy.
RP1.09 : Are you sure about your answer?
S3P1.09 : (Thinking) Yes, Bu.

Transcription 3.2
RP2.02 : Can you tell me about the given information on it?
S3P2.02 : Alfarizy buys 8 pencils and pays Rp40,000.00 for it.

RP2.03 : Another?
S3P2.03 : No, Bu. Only the question remains.
RP2.04 : OK, then. What is the question?
S3P2.04 : How many rupiahs Daffa has to spend to buy 20 pencils.
RP2.05 : Can you tell me about your answer?
S3P2.05 : 8 pencils costing RP40,000.00. The cost to buy 20 pencils is supposed as \( x \).
RP2.06 : Why you suppose the cost to be found by \( x \)?
S3P2.06 : To make it easier to be multiplied.
RP2.07 : Multiplied by what?
S3P2.07 : Multiplied it by 8 and multiplied 20 by 40,000.

RP2.08 : So, you will do the cross multiplication.
S3P2.08 : Yes.
RP2.09 : Can explain why \( 8/20 \) equal to \( 40,000/x \)?
S3P2.09 : Because the price of pencil is the same.
RP2.10 : Meaning?
S3P2.10 : The ratio of the number of pencils is the same with the ratio of rupiahs to spend those pencils.
RP2.11 : Ok. Then?
S3P2.11 : I do the cross-product rule to find \( x \).
RP2.12 : So, the result is …
S3P2.12 : It needs Rp100,000.00 to buy 20 pencils.

In general, subject LA used informal, qualitative, and formal reasoning in figuring out direct proportion problems. It can be seen when subject LA solved the given problems by using use ratio as a unit, make qualitative comparison, use cross-product rule, and use algebraic symbols to represent proportions with full understanding of functional and scalar relationships. According to Lamon’s classification of proportional reasoning [24], subject LA used constructive strategies to figure out direct proportion problems.

5. Conclusion and suggestion
5.1. Conclusion
Student with high level of anxiety in mathematics had a tendency to fail in connecting the given information listed in the problem with the concepts that she has already had in her mind. Although she made a connection between the concepts of comparing two numbers with the given information in determining which one will receive more chocolate (problem P1), she did not show the connection for the rest of problems. For example, in solving problem P2, instead of finding the unit price of a pencil, she directly multiplied the numbers listed in the problem without considering the given information. In general, it can be summarized that student with high anxiety in mathematics used non-constructive strategies in solving direct proportion problems. The strategies were use additive relationships, response without reasons, or use numbers, operations, or strategies randomly.

Student with medium level of anxiety in mathematics tended to connect the given information listed in the problem with the concepts that she already had in her mind. In answering problem P1, she made a connection between student’s ide in comparing ratios of the chocolate received by girl and boy respectively with the concept of comparing two fractions in order to determine which one will receive more chocolate. Problem P2 can be solved after student can make a connection between the concepts of division of integer with the student’s idea in finding the unit price of pencil. In general, it can be
summarized that student with medium anxiety level in mathematics tended to use constructive strategies to figure out the given problems. It can be seen when student mostly used constructive strategies (e.g. qualitative comparison and use rate as a unit) rather than non-constructive strategies (e.g. response without reasons) in solving direct proportion problems.

In order to solve the given problems, student with low level of anxiety in mathematics connected the given information listed in the problem with the concepts that she has already had in her mind. In solving problem P1, she connected the concept of division in finding the ratio of chocolate received by girl and boy, while she also connected the concept of division and multiplication in determining the unit price of pencil and the cost of 20 pencils respectively. In general, it can be summarized that student with low anxiety level used constructive strategies in solving direct proportion problems. The strategies used by student to solve proportion problems are use ratio as a unit, make qualitative comparison, use cross-product rule, and use algebraic symbols to represent proportions with full understanding of functional and scalar relationships.

5.2. Suggestion
This study is focused on describing the profile of students’ understanding of proportion based on mathematics anxiety level for female student. Further studies are needed to explore more about students’ anxiety level in mathematics by considering mathematics achievement, age, or other aspects.

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