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STUDENTS' MATHEMATICAL CONNECTION PROCESSES IN PROBLEM POSING BASED ON REFLECTIVE-IMPULSIVE COGNITIVE STYLE

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Abstract

This study aims to describe the student's mathematical connection processes in problem-posing reviewed by reflective-impulsive cognitive style. This research is descriptive qualitative with chosen subjects are two female eleventh graders, one with reflective cognitive style and one with impulsive cognitive style, both have a high mathematical ability. The subjects were chosen through analysis of math ability test (*TKM*), Matching Familiar Figure Test (*MFFT*), problem-posing test (*TPM*), and interview results. The result shows that: (1) the reflective student's mathematical connection processes in problem-posing are done consecutively. At understanding information stage, the student identifies mathematics and other science concepts, also their connection with daily lifes. At planning the problem-posing, she planned to make a story problem concepts that have been identified. At making problems, she did as plan and gave clear reasons for the information usage in problem and solution. When re-checking, she checked the information's completeness in the problem and the solution's correctness by proving it. (2)The impulsive student's mathematical connection processes in problem-posing are done dynamically, but didn't do the re-checking stage. At understanding information, the student couldn't directly identify mathematics and other sciences concepts, then starting the processes again by reading the information repeatedly, then continued to connect it with the real-world context. At planning the problem-posing, she planned to make a story problem connected with concepts that have been identified. At making problems, used all the information given and gave no apparent reason for it.
Keywords: cognitive style, reflective, impulsive, mathematical connection, problem-posing

INTRODUCTION

Mathematics is a logical science consisting of shapes, magnitudes, arrangements, and concepts related to each other (Hidayat & Sariningsih, 2018). According to Baiduri et al. (2020) the relationship between mathematical elements is seen in data, definitions, principles, operations, procedures, and mathematical themes and processes that indicate that mathematics is not an isolated set of ideas. Therefore, students need to have the ability to connect various mathematical ideas and concepts in learning mathematics. The ability to connect multiple mathematical ideas and concepts in learning mathematics defines "mathematical connections" (Eli et al., 2013). Saminanto & Kartono (2015) argue that mathematical connections can connect concepts in mathematics with non-mathematical concepts. Meanwhile, according to Islami et al. (2018), mathematical connections are between mathematical concepts, other sciences, and real life. From some of these opinions, it can be concluded that mathematical connections are the ability to connect mathematical concepts, mathematical concepts with other disciplines, and mathematical concepts with problems related to real life.

Mathematical connections are essential for students because they are one of the standard competencies of the thinking processes in mathematics learning. Based on NCTM (Allen et al., 2020), the thinking processes in mathematics learning involve five main standard competencies, namely problem solving, reasoning, connection, communication, and representation. According to Arifin et al. (2019), the concept of mathematics studied at the high school level has a lot of relevance to the material at the previous education level and the concept study at the secondary school level itself. Furthermore, according to Prihastanto & Fitriyani (2017), mathematics learning becomes more meaningful when students can relate the concepts they learned with previous concepts or other disciplines. Students need to have mathematical connection skills to connect these concepts. Without these abilities, students will have difficulty remembering and learning too many concepts and skills separately (Allen et al., 2020). Therefore, mathematical connections are important for students to understand more durably and deeply in learning mathematics.

The process of mathematical connection is thinking in recognizing and using interrelationships between mathematical ideas (Nordheimer, 2011). Kurz divides the mathematical connection process into two categories, namely internal connection and external connection. Internal connection occurs when there is an inter-connection in mathematics, while external connection occurs when there is a mathematical connection with another subject or daily life (Islami et al., 2018). Baiduri et al. (2020) describe the internal connection and external connection into three aspects of mathematical connection: connection in mathematics, mathematical connection with other sciences, and mathematical connection with daily life. Meanwhile, according to NCTM (Allen et al., 2020), the mathematical connection process is to recognize and use relationships between ideas in mathematics, understand that ideas in mathematics are interconnected, and build on each other to produce a complete unity, as well as recognize and apply mathematical ideas to contexts outside of mathematics. The indicators of mathematical connection processes in this study are as follows:

1. Connections in mathematics
   a. Identify mathematical concepts contained in the situation or information provided.
   b. Use connections between concepts in mathematics.
2. Mathematical connections with other disciplines
   a. Identify other discipline concepts contained in the situation or information provided.
   b. Using mathematical concept connections with other disciplines.
3. Mathematical connections with the real world or everyday life
   a. Identify the context in daily life contained in the situation or information provided.
   b. Using the connection of mathematical concepts with their application in the real world or everyday life.

Rohmatullah (2018), in his research, revealed that students' mathematical connections can be seen in problem-posing activities. Problem posing is a learning method in which students are asked to make a problem from a given situation (Silver, 2013). Ellerton (2013) added that problem-posing not only creates new problems, but students can also reformulate the given problem by changing or adding information, including objects, conditions, and context for the next problem to be solved. Based on some of these opinions, it can be concluded that problem submission is a learning activity in which the teacher provides certain information or problems, then the student creates or reformulates a problem from the information and then seeks a solution.

The ability to pose a problem is essential for students in math learning. Cockcraft dalam (Arıkan & Ünal, 2015) states that if problem-solving is supposed to be a heart in mathematics learning, then problem posing is the blood vessel. In other words, problem-posing has a role that is no less important than problem-solving. Strengthened by The National Council of Teachers of Mathematics, it would be better if students could formulate interesting problems based on various situations, inside and outside mathematics, and the ability to make problems should be emphasized in learning activities (Jiang & Cai, 2014). Furthermore, according to Bonotto (Siswono, 2010), the ability to pose problems positively influences students in solving math problems and provides more insight to teachers to know students' understanding of various mathematical processes and concepts.

Problem posing is classified into three types by Silver and Cai. Pre-solution posing is when students make problems from data, situations, and information provided using their own sentences. Then, within-solution posing is when students can make new questions that are simpler to facilitate the resolution of complex problems faced by the student. Lastly, post-solution posing is when students ask a new problem that resembles a solved problem (Muhtarom dkk, 2020). The application of pre-solution posing in learning can train students to create questions based on stories, diagrams, drawings, and representations, but it is also helpful to teach students to connect the information they have with previously studied material (Arıkan & Ünal, 2015). Based on this opinion, there is a possibility of finding the mathematical connection processes of students with pre-solution posing because there is the process of connecting the information obtained with the knowledge that students already have. Therefore, this study will be used to apply the problem of pre-solution posing type.

Problem posing is a learning activity in which students create problems from a given condition, information, or situation. Stoyanova & Ellerton (Bonotto, 2013) identifies three categories of situations from problem posing. Firstly, free-situation meaning students can make problems without limitation, semi-structured, i.e., students are asked to create questions similar to the questions already provided or from specific drawings and diagrams, and structured means students make problems by reformulating the situation that has been solved or changing the condition and question of the given problem. This study will be used semi-structured situations because it corresponds to the type of pre-solution posing in which students are asked to make problems out of context given with their own sentences. The implementation of the problem-posing consists of several stages. According to Siswono (2009), the steps in posing problem that will be used in this study are as follows:

1. Understanding information
   Students must understand the provided information. Understanding is characterized by determining what is known in the provided information or situation fully.
2. Planning the problem-posing
   Students must determine what information to use to create a question, determine whether the given information is sufficient or less to make a question, and determine the strategy or ways to make problems.
3. Making problems
   Students carry out the strategy according to what has been compiled and set in the previous stage and start making problems.
4. Re-checking questions, solving strategy, and answers
   Students reflect by double-checking the completeness of the information from the problem, then checking the correctness and completeness of the solution process.

Problem posing can be used to observe students' mathematical understanding, which can be demonstrated by the interconnection between mathematical ideas and concepts (Barmby et al., 2009). In addition, according to Ayllon et al. (2016), problem-posing can be used as an assessment tool to explore one's thinking process, including the students' mathematical connection processes, because the mathematical connection process is the thinking process in constructing knowledge of mathematical ideas through the relationship between experience, language, drawing and mathematical symbols (Haylock, 2007). The relationship between the connection process and problem-posing is also supported by the opinion of Muhtarom et al. (2020) that problem-posing activities can encourage students to make connections between different concepts to build their understanding. Based on the explanation, the mathematical connection processes in problem-posing are the thinking process in recognizing and using the interrelationship between mathematical concepts, mathematical concepts with other disciplines, and mathematical concepts with their application in daily life in posing problems.

The problem-posing and mathematical connection process of each student can have differences. These can be caused by several factors, one of which is cognitive style. Cognitive style is defined as a person's character on feeling, remembering, organizing, processing, and solving problems, by distinguishing, understanding, storing, realizing, and utilizing information (Warli, 2013). While Witkin (Arifin et al., 2019) defines cognitive style as an approach to receiving, processing, organizing, and presenting the information. Cognitive style relates to the process of knowledge construction, such as how a person acquires and uses his knowledge through the perception and processing of information received (Setyawan & Rahman, 2013). From some expert opinions, cognitive style is a variation of each individual in processing information in response to a problem encountered.

The cognitive style consists of several valuable types for classifying students based on decision making, distinguishable by the speed, accuracy, and electability showed to search and manipulate information (Satriawan et al., 2018). However, this study will focus on reflective and impulsive cognitive styles. Students with reflective cognitive style have a slow characteristic in solving a problem but tend to correctly answer because they're more thorough. While students with impulsive cognitive style have a quick feature in solving a problem, they tend to wrongly answer because they're less careful (Yuniasari & Zainuddin, 2019). Reflective-impulsive cognitive style can affect a students' mathematical connection processes. This is in line with the research results by Diana & Irawan (2017) that in problem-solving, the mathematical connection process of reflective subjects is more complete and reaches a higher level than impulsive subjects. Reflective-impulsive cognitive styles can also lead to differences in the stages of student problem-posing. Based on Arofah & Masriyah's research (2019) results at each step in posing problems, reflective students are more thorough and perform each step more fully than impulsive students who tend to only read at a glance and do fewer stages in posing problems.

Research focusing on connection processes isn’t new in the world of mathematical education studies. Some researchers have examined topics related to mathematical connection processes, such as research by Islami et al. (2018) which revealed that high logical-mathematical intelligence students do more connection processes than low logical-mathematical intelligence students in solving geometry problems. It can be concluded that students' connection processes can be influenced by logical-mathematical intelligence. Furthermore, the student connection process may differ by gender. Despite having equivalent mathematical skills, there are differences in the connection process when understanding problems, solving strategies, and implementing problem-solving (Baiduri et al., 2020). While the difference in students' mathematical connections in posing problems has been identified in a previous study by Asfaroh & Ekawati (2019), students' mathematical ability can affect connections when posing problems. However, it is still rare for research to focus on how students' mathematical connection processes when posing problems, especially based on cognitive styles. Therefore, based on this explanation, the purpose of this study is to find out how students' mathematical connection processes in problem-posing are reviewed from different cognitive styles that are reflective and impulsive.

METHOD

This research is qualitative descriptive research that aims to describe students' mathematical connection processes in problem-posing based on reflective and impulsive cognitive styles. The research subjects were selected from 20 eleventh graders who had studied three-variable linear equation system material and were selected by mathematical ability test (*TKM*) consisting of five questions equivalent to the National Exam standard that studied by students. The results of the math ability test are then analyzed by category in Table 1 below.

Table 1. Category of Math Ability Score

Score	Mathematics Ability
$80 \leq score \leq 100$	High
$60 \leq score < 80$	Moderate
$0 \leq score < 60$	Low

After the math ability test (*TKM*) was analyzed, 11 high-level students, 6 moderate-level students, and 3 low-level math ability students were obtained. Subject selection is based on the same high mathematical ability and same gender. The chosen subject is intended so that the results obtained do not differ in mathematical ability and gender differences.

A total of 8 high math ability students were then re-selected by being given the Matching Familiar Figure Test (*MFFT*). The test consists of 13 question items to determine the type of cognitive style, adapted from Jerome Kagan, which has been developed by Warli (2010). The results of MFFT then analyzed and classified into 4 categories, namely: impulsive, reflective, fast accurate (FA), or slow inaccurate (SNA). Students are considered reflective when completing above the median time ($t > 39{,}39\ seconds$) and below the median frequency ($f \leq 2$). While students are considered impulsive if completing below the median time ($t \leq 39{,}39\ seconds$) and above the median frequency ($f > 2$). After the cognitive style test results were analyzed, two subjects were assigned. The selected subjects are based on the results of tests that have been done and the subject's willingness to provide data. The chosen subjects are:

1. Female subject with high mathematical ability and reflective cognitive style, and
2. Female subject with high mathematical ability and impulsive cognitive style

Subjects were then given a problem-posing test (*TPM*). TPM consists of two different semi-structured situations, with the first situation having a simpler context. The results of TPM were analyzed with mathematical connection indicators by NCTM (Allen et al., 2020) and problem-posing stages by Siswono (2018) that have been adjusted by the researcher. The indicator of connection processes in problem-posing is listed in table 2 below.

Table 2. Mathematical Connection Processes in Problem Posing Indicators

Problem posing stages	Mathematical Connection Processes in Problem Posing Indicators	Code
Understanding information	1. Identify mathematical concepts from the provided information.	MI-1
	2. Identify the connection of mathematical concepts from the provided information with other disciplines.	MI-2
	3. Identify the connection of mathematical concepts from the provided information with real life.	MI-3
Planning the problem-posing	4. Formulate a plan to make problems using the connection of mathematical concepts found from the provided information.	MR-1
	5. Formulate a plan to make problems using the connection of mathematical concepts with other disciplines.	MR-2
	6. Formulate a plan to make problems using the connection of mathematical concepts with real life.	MR-3
Making problems	7. Create problems by using the connection of mathematical concepts found from the provided information.	MM-1
	8. Create problems by using the connection of mathematical concepts with other disciplines.	MM-2
	9. Create problems by using the connection of mathematical concepts with real life.	MM-3
	10. Write down the solution steps of the problem.	MM-4
Re-checking questions, solving strategy, and answers	11. Check the completeness of the information needed on the questions.	MS-1
	12. Re-check the correctness of the solution steps made.	MS-2

Then the subjects were given an interview test based on a guideline consisting of a list of questions to further convince the researcher about students' ability to posing math problems. The researcher also wanted to know students' explanation orally that was not written on the answer sheet and more detail about students' mathematical connection processes in problem posing. The data obtained is qualitatively analyzed by reducing the data, display the data, and drawing conclusions.

RESULTS AND DISCUSSION

The results and discussion on students' mathematical connection processes in problem-posing based on reflective-impulsive cognitive styles, including written data of the Problem Posing Test (*TPM*) and the interview results, will be explained in this section. Encoding for *TPM* and interview data are based on mathematical connection processes in problem-posing indicator codes in Table 2. While subjects' interview transcript, will be given the code "P" for the transcript of the question by the interviewer and the code for the subject's answer, "SR" is the subject with reflective cognitive style and "SI" is the subject with impulsive cognitive style. The code for both is then added by number at the end as a sequence of questions or answers.

A. Mathematical Connection Processes in Problem Posing by The Student with Reflective Cognitive Style.

Based on the test work results by the subject below, the process can be described as follows.

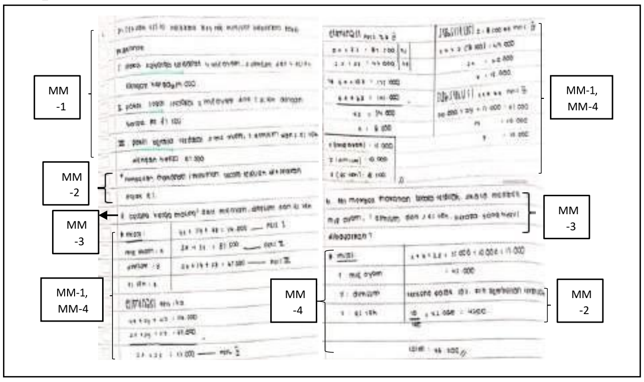

Figure 1. The Reflective Student's Work of First Context

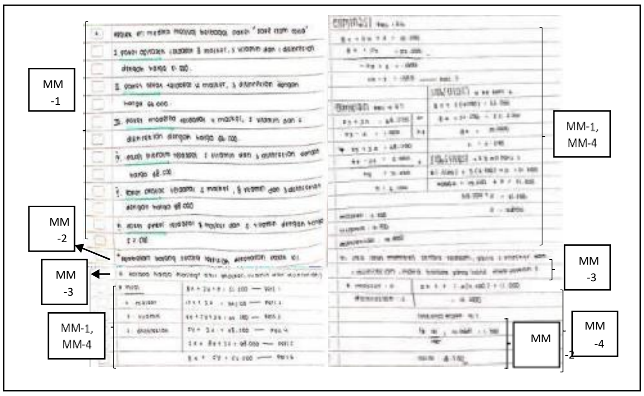

Figure 2. The Reflective Student's Work of Second Context

The first step that the student with reflective cognitive style (*SR*) does after receiving the assignment sheet is to read the instructions given, then observe the provided images in the first and second context, after which *SR* categorizes the type of food in context 1 and the type of item in context 2 and then observe the price per package, *SR* claimed to have never made a math problem before. At the time of the interview, *SR* revealed the difficulties she faced when understanding information and how to overcome the obstacles, as in the following dialogue section.

P-3 : *Do you find it difficult to understand the given situation?*

SR-3 : *On the first task, I was confused when I saw the description of buying taxed separately. I was confused about whether the tax applies when purchasing only 1 item or more. While on the second task, I was confused because of more packages.*

P-4 : *How do you overcome these difficulties?*

SR-4 : *Finally, I decided that it is impossible to buy 1 item alone can be taxed, because in my experience, when buying in a restaurant, all goods are totaled first and then added tax. Then for the second task, it is quite helpful to do this second task from the first task.*

When having difficulty understanding the second context, *SR* can overcome it because it is helped by the first context that is simpler than the second context. After successfully overcoming the difficulties, *SR* continued the process by writing down and mentioning all the information in both contexts on the task sheet.

The process is continued by identifying the mathematical concept from the given information (*MI-1*). When the researcher asks about the connection of provided information with a mathematical concept, *SR* can directly answer that the information provided relates to the mathematical concept in the SPLTV material as in the following dialogue section.

P-6 : *Does the information you find connect to a concept in mathematics?* **(MI-1)**

SR-6 : *Yes, miss, the concept connect to the Three Variable Linear Equation System (SPLTV)* **(MI-1)**

SR explains that she can instantly identify concepts after categorizing the type of food and goods and the price per package, then she converts them to mathematical forms and realizes that the given packages can be converted into several equations. *SR* can also explain the relationship between variables, coefficients, and equations. Then the process is continued by identifying the connection of mathematical concepts from the provided information with other disciplines (*MI-2*). *SR* explained that there is a tax concept related to economic subjects in the provided information, such as the following dialogue.

P-7 : *Does the information provided have anything to do with a concept in other subjects? Explain.* **(MI-2)**

SR-7 : *Economic, miss because there is a tax on purchasing food/beverage in the first picture and goods in the second picture separately.* **(MI-2)**

After that, the process is continued by identifying the connection of mathematical concepts from the information provided with real-life (MI-3). SR reveals that the first image reminds her of the menu at a fast-food restaurant, and in the second image, she usually finds a brochure image on an online shop site. The explanation by SR is contained in the following dialogue section.

P-8 : *Does the provided information have a connection with real life? Explain.* **(MI-3)**

Answers for the first context

SR-8 : *Usually, I encounter such pictures on the menu at fast-food restaurants such as KFC and MCD, there are packages.* **(MI-3)**

Answers for the second context

SR-8 : *I've encountered such images on the market place such as online buying and selling* *applications. Some packages look like that.* **(MI-3)**

The mathematical connection process is then continued by planning the problem-posing. *SR* formulates a plan to make problems using the connection of mathematical concepts found from the provided information (*MR-1*) by directly creating problems related to SPLTV because, at the time of understanding the information, *SR* already knows about what is asked to be made from the given context, it can be seen in the following interview dialogue section.

P-9 : *What is your strategy for asking questions using mathematical concepts that you find from that information?* **(MR-1)**

Answers for the first context

SR-9 : *From the known information, there are 3 packages, well each package has several menus that are the same, but the amount and price are different, from there it is visible that the concept is SPLTV. So my plan was to find out each cost of iced tea, dim sum, and chicken noodles.* **(MR-1) (MR-3)**

Answers for the second context

SR-9 : *Almost the same as the first task, miss. I made a question that no matter how I have to solve it by using this known information, also use steps that according to the concept of SPLTV.* **(MR-1)**

Furthermore, *SR* conducts the process of formulating a plan to raise problems using the connection of mathematical concept from provided information with other disciplines (*MR-2*). *SR* plans to create a problem by requiring to buy food or drink in the first context and goods in the second context separately so that the concept of tax can be applied when solving the problem. This step can be seen in the following interview dialogue section.

P-10 : *What is your strategy for making questions using the connection of mathematical concepts you find with other disciplines?* **(MR-2)**

SR-10 : *So there is a 10% tax if buying goods separately, well I made a story problem of buying goods outside the package, with the concept of SPLTV I first look for the price of each item, then I make a question with the settlement using the tax.* **(MR-2)**

SR then carried out formulating a plan to pose a problem using the connection of mathematical concepts with real-life (*MR-3*). *SR* plans to make a story problem with the concept of SPLTV that can be associated with real-life by blending in on related questions that she has been solved before. Further explanation of *SR* can be seen in the following interview section.

P-11 : *What is your strategy for using the connection of mathematical concepts you find with real life?* **(MR-3)**

Answers for the first context

SR-11 : *Because I already knew that the concept was SPLTV, so I made a story problem where someone bought food/drinks separately outside of the package.* **(MR-3)**

Answers for the second context

SR-11 : *Because I already knew that the concept was SPLTV, so I made a story where someone bought an item separately outside of the package.* **(MR-3)**

The next step is the mathematical connection process in making problems. *SR* subject makes problems using mathematical concepts found from the provided information (*MM-1*) by writing down the known information first and then converting it to the equation form as seen in figure 1 and figure 2. In the first context, *SR* used all given information to create and solve problems, because according to her, to make the SPLTV problem, it takes a minimum of three equations, as seen in figure 1. While to solve the problem from the second context, *SR* only uses three equations, namely equations 1, 4, and 6 of the six equations because, for her, it is enough to find the price of each item, the *MM-1* process in the second context can be seen in figure 2. After that, *SR* made a problem using the connection of mathematical concepts with other disciplines (*MM-2*), namely the purchase separately, so that 10% tax information can be used when calculating the total payment. As in the first context, *SR* made a separate purchase of 1 chicken noodle, 1 dim sum, and 2 iced tea, as seen in figure 2, while for the second context, *SR* made a separate purchase of 2 masks and 1 disinfectant, as shown in figure 2. Then *SR* makes a story problem with a situation in real life, as shown in figures 1 and 2. This indicates *SR* has raised the problem using the connection of mathematical concepts with real-life (*MM-3*). *SR* could create two story-based problems. The first question is to find the price of each item, and then the second question is about purchasing goods separately outside the available packages. *SR* also writes down the complete steps for solving the problem (*MM-4*), as shown in figures 1 and 2.

The last stage is re-checking questions, solving strategy, and answer. This process is done by *SR* after creating and solving the problem. *SR* re-checking the completeness of the information needed on the question (*MK-1*), it is proven correct by looking at the work results, written entirely and consecutively as in figures 1 and 2. This process can be seen in the following dialog section.

P-13 : *Have you double-checked what you made?* **(MK-1)**

SR-13 : *Yes, I reread it, miss.* **(MK-1)**

P-14 : *How do you make sure that the questions you create are following the provided information?*

SR-14 : *Because I used all known information, miss*

P-15 : *Do you think the information you use to make up questions is enough?*

Answers for the first context

SR-15 : *Based on the information, it appears that SPLTV has enough three equations to find the price of each noodle, iced tea, and dim sum.* ***(MK-1)***

Answers for the second context

SR-15 : *Based on the information SPLTV concept, it is enough even more because there are six equations, although only three equations can be used to find each mask, vit. C, and disinfectant price.* ***(MK-1)***

Then SR is also re-checking the correctness of the steps to solve the problem made (MK-2). SR writes down the solution steps thoroughly, and the final answer obtained is correct, as can be seen in figures 1 and 2. SR can also give the reason with certainty, clarity, and precisely when the researcher asked how to ensure the correctness of the answer as in the following dialogue section.

P-16 : *Have you re-checked the solution to the problem you made?* **(MK-2)**

SR-16 : *Yes, I have.* **(MK-2)**

P-17 : *How do you make sure that your solution steps are correct?*

SR-17 : *Because previously, I have studied and worked on a question like this material, so that becomes my reference to make sure my steps are correct.* **(MK-2)**

P-18 : *Do you think there was a mistake with your answer? Is there any correction?*

SR-18 : *I think there is no mistake, miss, because I've checked it by substituting the price I found into a known equation, and it turned out the result was the same.* **(MK-2)**

B. Mathematical Connection Processes in Posing Problem by The Student with Impulsive Cognitive Style.

Based on the test work results by the subject below, the process can be described as follows.

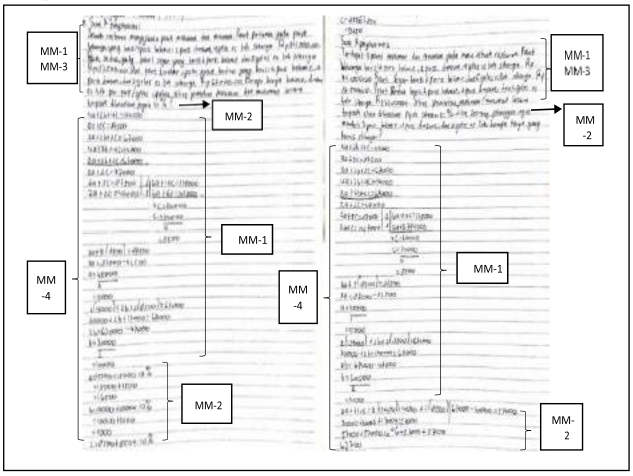

Figure 3. The Impulsive Student's Work of First Context

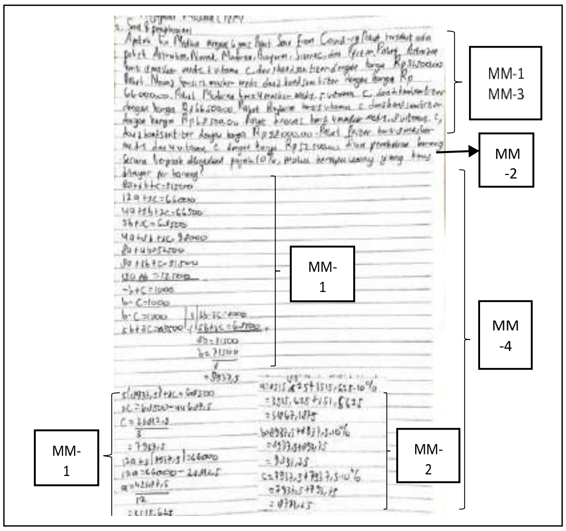

Figure 4. The Impulsive Student's Work of Second Context

The first step that the student with impulsive cognitive style (SI) does after receiving the assignment sheet is understanding and analyzing the given situation by reading it first. SI claims to have never made a math problem before. At the time of the interview, SI revealed the difficulties she faced when understanding the information and how to overcome the difficulties, as in the following dialogue section.

P-3 : *Do you find it difficult to understand the given situation?*

Answers for the first context

SI-3 : *I had difficulty constructing words, and then I was confused about what problem to make.*

Answers for the second context

SI-3 : *I am more confused about figure no.2 because of more packages.*

P-4 : *How do you overcome those difficulties?*

Answers for the first context

SI-4 : *Because I had previously done a math ability test (TKM), I remembered making a question that looks like a problem in the test.*

Answers for the second context

SI-4 : *Because in the previous task, I have made a problem, so I can make the question again more easily in task no.2.*

Because *SI* has never made a question before, she is confused when it comes to making a question based on the given context because she does not understand the meaning of the given context, so to overcome it, *SI* recalls the *TKM* test she worked on before and thinks that the question that should be made may be related to the previous test. When having difficulty understanding the second context, *SI* can overcome it because she is helped by the first context, which is simpler than the second context. After successfully overcoming these difficulties, *SI* continues the mathematical connection process in understanding the information by mentioning all the information in both contexts on the task sheet.

The process continued by identifying the mathematical concept from the provided information (*MI-1*). When the researcher asks about the connection of mathematical concepts from the provided information, *SI* is confused and says that the provided information relates to the mathematical concept in the SPLDV material. After *SI* tries to re-read the given context, she realizes there are three equations. Then, *SI* can answer the correct concept in question, namely SPLTV. However, *SI* still mentions SPLDV as in the following dialogue section.

P-6 : *Does the information you find connect to a concept in mathematics?* **(MI-1)**

SI-6 : *Yes, miss, because there are equations that can be made from the menu. I remember the name. Is it SPLDV? (read again), oh, there are 3 equations, so SPLTV miss? This means there are SPLDV and SPLTV with equations and inequations in them.* **(MI-1)**

However, after the researcher asked *SI* how many variables she had gained from equations, *SI* realized the error and then answered again with more certainty that what was meant was the concept of SPLTV. Then the process is continued by identifying the connection of mathematical concepts from the provided information with other disciplines (*MI-2*). At first, *SI* was confused because she did not remember the name of the subject with the concept of tax and then tried to guess as in the following dialogue section.

P-7 : *Does the provided information have anything to do with a concept in other subjects? Explain.* **(MI-2)**

SI-7 : *Sorry miss, I forgot. Administration? economics? (read again) oh, miss, I just remember the 10% tax is the economy, it seems.* **(MI-2)**

Although *SI* lacks confidence in delivering the answer at first, finally, *SI* has managed to connect tax information with economic subjects after reading and rethinking. After that, the process is continued by identifying the connection of mathematical concepts from provided information with real-life (*MI-3*). *SI* reveals that the first image reminds her of a franchise outlet, and the second image is like a picture of a sales package she usually finds in an online shop app. The explanation by *SI* is contained in the following dialogue section.

P-8 : *Does the provided information have a connection with real life? Explain.***(MI-3)**

Answers for the first context

SI-8 : *I've encountered such pictures on the menu at franchise stores such as MCD or KFC miss. In online shops, I also have seen such bundles.* **(MI-3)**

Answers for the second context

SI-8 : *I've encountered such pictures on online shop buying and selling apps. There are such packages.* **(MI-3)**

The mathematical connection process is then continued by planning a problem-posing. *SI* formulates a plan to make problems using the connection of mathematical concepts found from the provided information (*MR-1*) by making problems related to the given information. Because when understanding the information, *SI* knew what questions are asked to be made, while for the second context, *SI* plans to make a question similar to the problem that has been done, she can't finish creating another problem. This can be seen in the following part of the interview dialogue.

P-9 : *What is your strategy for making questions using mathematical concepts that you find from that information?* **(MR-1)**

Answers for the first context

SI-9 : *After I read the information, then I mentioned it, and then I made the question.* **(MR-1)**

Answers for the second context

SI-9 : *First, I analyze the connection, relive the questions I've been working on, and then made up the question.* **(MR-1)**

Furthermore, *SI* conducts the process of formulating a plan to pose problems using the connection of mathematical concepts of the provided information with other disciplines (*MR-2*). *SI* plans to make a question of purchasing food or beverage in the first context and goods in the second context separately so that the concept of tax can be applied when solving the problem. The explanation can be seen in the following interview dialogue section.

P-10 : *What is your strategy for making questions using the connection of mathematical concepts you found with other disciplines?* **(MR-2)**

SI-10 : *So the description when buying separate goods will be subject to 10% tax because it is known only the price per package, so we have to find the unit price first with SPLTV, after that I add with 10% tax.* **(MR-2)**

SI then formulates a plan to make the problem using the connection of mathematical concepts from the provided information with real-life (*MR-3*). *SI* plans to make a story problem with the concept of SPLTV that can be associated with real-life, such as a situation where someone wants to buy an item outside the package. *SI* explanation can be seen in the following interview section.

P-11 : *What is your strategy for making questions using the connection of mathematical concepts that you found with real life?* **(MR-3)**

Answers for the first context

SI-11 : *I made a story problem miss, yeah so I mention all the information, and then I write about someone want to buy the food separately.* **(MR-3)**

Answers for the second context

SI-11 : *I made a story problem miss, which relates to someone buying a mask, vit. C, and hand sanitizer separately.* **(MR-3)**

The next step is the mathematical connection process in making problems. *SI* performs the process of making problems using mathematical concepts found from the provided information (*MM-1*) by arranging all known information into sentences to create questions, as seen in figure 3 for the first context and figure 4 for the second context. In the first and second contexts, *SI* uses all the information given to create a problem. For the first context solution, all equations obtained is used, as seen in figure 3, while to solve the problem from the second context, *SI* uses four equations, namely equations 1, 2, 4, and 6 of the six equations, the reason *SI* chooses the four equations is less clear because she only chooses based on experiments, *MM-1* process in the second context can be seen in figure 4. After that, *SI* made a problem using the connection of mathematical concepts with other disciplines (*MM-2*), namely the separate purchasing, so that 10% tax information can be used when calculating the total payment. As in the first context, *SI* makes a separate purchase of one serving of each food and drink and the purchase of 2 bakmi, 1 dim sum, 2 ice tea as in figure 3, while for the second context, *SI* makes a separate purchase of one item each as seen in figure 4. Then *SI* makes a story problem with the situation in real life, as shown in figures 3 and 4. This indicates that *SI* has made problems using the connection of mathematical concepts with real-life (*MM-3*). *SI* can create two questions for the first context, but she only makes one question for the second context because she runs out of time. The first question is to find the price of each item, and the second question is about purchasing goods separately outside the package. *SI* writes down the steps for solving the problem (*MM-4*) without being captioned and only shows the calculation as seen in figures 3 and 4.

The last stage is re-checking questions, solving strategy, and answers. After creating and solving the problem, *SI* didn't double-check the completeness of the information needed in the question she created (*MK-1*), as seen in the following dialogue section.

P-13	:	*Have you double-checked what you made?* **(MK-1)**
SI-13	:	*Honestly, I haven't, miss, because the time is up*

SI also did not re-check the correctness of the solving steps (*MK-2*). Although *SI* writes down the complete steps of the solution, there is an error in the final answer to the question from the second context, as shown in figure 4. *SI* also doubts the correctness of the solution she wrote because it has not been examined, as in the following interview dialogue section.

P-18	:	*Do you think there was a mistake in your answer? Is there any correction?*
SI-18	:	*Honestly, I haven't, miss, because the time is up*

C. Discussion

Based on the data analysis and results, the student with reflective cognitive style (*SR*) can carry out the mathematical connection process at each stage of the problem-posing completely and consecutively. When understanding information, subject can directly identify the concept of SPLTV after reading the provided information and explain the connection between variables, coefficients, and equations. This step is in line with Prihastanto & Fitriyani (2017) findings, which is a reflective cognitive-style subject capable of understanding how ideas in mathematics relate to each other and build on each other. Then *SR* was able to identify the concept of other subjects correctly, namely taxes from economic subjects, and find information related to the real world, that is in fast-food restaurants and market, and the application of taxes for purchasing goods. When making the plan, *SR* planned to make a story problem based on her experience that is purchasing goods separately that is completed by using SPLTV and tax cocepts. This is in line with Stoyanova and Ellerton's in (Bonotto, 2013) that *SR*'s mathematical experience is required in problem-posing. When making the problem, *SR* did it according to the plan by using all the provided information. The solution in the first context used all known equations, while for the second context used only three equations from six equations. *SR* gave a clear and precise reason for using the information, the SPLTV problem can be solved with a minimum of three equations. In each context, *SR* made two story problems. The first problem is finding the price of each item, and the second problem is purchasing goods separately so that the concept of tax can be applied. When rechecking, *SR* can ensure the information completeness that used to create the problem by writing it down completely, and in detail, she can also provide the solution correctness by matching it to known information. In solving the problem, *SR* can explain and write each step clearly and completely. This result is in line with Yuniasari & Zainuddin (2019) findings, student with reflective cognitive style has a slow feature in solving problems, but tends to correctly answer, because they are more thorough

The student with impulsive cognitive style (*SI*) did the mathematical connection processes in problem-posing but haven't reached the stage of re-checking questions, solving strategies, and answers. When understanding information, *SI* needs more time to identify the SPLTV concept from the provided information. When determining the tax concept, *SI* has difficulty remembering it, so she has to read repeatedly. Repeatedly reading it can make it easier for the subject to identify the concept from the provided information (Asfaroh & Ekawati, 2019). But when connecting context with daily life, *SI* can confidently replied that she has encountered it in fast-food restaurants and online shops, and often encountered tax concepts when buying something. In the next stage, *S*I plans to make the story questions first and answer it by connect it with her experience. This is in line with Arofah & Masriyah's (2019) findings that impulsive subjects make questions first and then answer them. When making the problem, *SI* used all the provided information, then compiled it into a sentence. When solving the first context, *SI* used all known equations. For the second context used four from six equations, she was unable to give a clear reason for the information used rely on experiments. For the first context, *SI* made two problems, as for the second context is only able to make one problem, they're made by purchasing goods separately so that the concept of tax can be applied. *SI* can't confirm the information completeness to make the problem because of time out, nor she ensures the answer correctness, which is also proven by error. According to Rahman (2008), impulsive subjects tend to make mistakes because they don't use other alternatives.

The results showed the similarity, that is both performed inter-connecting mathematical concepts, mathematical connections with other sciences, and real-life at the stage of understanding information, planning problem-posing, and making problems. The difference is that the student with reflective cognitive styles performs the connection processes up to re-checking questions, solving strategies, and answers, whereas the student with impulsive cognitive styles doesn't. The processes performed by the reflective student are more ordered than the impulsive student. The student with reflective cognitive styles demonstrates more prominent processes of understanding information and making problems, with better understanding, more complete explanations, and could ensure the answer.

CLOSURE

Conclusion

Based on the results of data analysis and discussion of students' mathematical connection processes in problem-posing, we can conclude that the student with reflective cognitive style has performed mathematical connection processes in problem-posing. When understanding information, the student identified mathematical concepts from a given context smoothly, then understand the connection between mathematical elements related to the concept. The process continued with correctly identifying concepts from other subjects, then connect the provided information with their application in real life. When planning the problem-posing, the student plan to make problems under mathematical and other sciences concepts that she has identified, the problem that will be made is story-based according to her experience. Continuing at making the problem, the student made problems as planned by using all the provided information. In the first context's solution, she used all information, while for the second context used only some information, then gave a clear and precise reason for the informations usage. In each context, the student make two problems. The first is to find the price of each item, and then the second is purchasing goods separately so the other sciences concept can be applied. The last process is re-checking. After made the problem and completed it, then re-checking the information's completeness, then re-checked the solution's correctness by matching it to the known information. The student explained and wrote down each step clearly, completely, and sequentially when solving the problem. From the explanation, it can be concluded that the reflective student's mathematical connection processes in problem-posing is consecutive, because at each stage, the student did it smoothly and gradually proceed to the next steps.

The student with impulsive cognitive style has performed mathematical connection processes in problem-posing but not until the re-checking stage. When understanding information, the student took a long time in identifying mathematical concepts. When identifying concepts from other sciences, the student also has difficulty remembering it, so she must re-read the information repeatedly, but she is confident when connecting the provided information with its application in the real life. In the next stage, the student plans to make a story problem based on the questions that she has been done. Then making the problem, she used all the provided information and arranged it into sentences. In the first context's solution, all information are used. For the second context only used some information. The student didn't give a clear reason for the information usage and rely on trial and error. For the first context, she could make two problems. As for the second context, only made one problem. After making problems and solving them, the student didn't re-check the information's completeness because of time out, nor did she re-check the answer's correctness, which is also proven by the existence of mistakes. Overall the impulsive student's mathematical connection processes in problem-posing is dynamic. When identifying mathematical and other science concepts, the student couldn't immediately do so and start the process again by repeatedly reading the information, only after that, she could proceed to the next processes.

Suggestion

Referring to the results of the discussion and conclusions obtained, the researcher give some suggestions, as follows:

1. For other researchers who will conduct similar research related to students' mathematical connection processes in problem posing, it is recommended to use reviews other than reflective-impulsive cognitive styles and high levels of mathematical ability. It is also advisable to choose materials and different types of situations to obtain more complete and in-depth data.
2. For teachers and prospective teachers, the results of this study can be used as a consideration when planning or making teaching and learning activities. It is advisable if teachers invite students to pose problems from a mathematical context related to other subjects and daily life more often, with more varied materials. Problem-posing activities can be helpful to encourage students to make connections between different concepts to deepen their understanding of the material.

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