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Students' Critical Thinking on PISA Mathematics Problems: Cases of Students with Low and High Self-Efficacy on Algebraic Task

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Abstract

This study aims to describe students' critical thinking on PISA problems on algebra content in terms of high and low mathematics efficacy. This descriptive qualitative research involves two junior high school students with high and low mathematics efficacy in one of the junior high schools in Jombang Regency. Data collection techniques were carried out by administering a mathematics efficacy questionnaire, Algebraic Content PISA Problems (ACPP), and interview guidelines. Data analysis was based on indicators of critical thinking ability (interpretation, analysis, evaluation, inference, explanation, and self-regulation). From the results of data analysis, critical thinking in the interpretation aspect shows that only students with high mathematics efficacy can write what is known and asked. Likewise, in the analysis aspect, it shows that only students with high mathematics efficacy can create a mathematical model of the given problem. In the evaluation aspect, students with high and low mathematical efficacy can write complete problem-solving. Likewise, in the inference aspect, students with high and low mathematics efficacy were able to draw conclusions logically. Likewise, in the explanation aspect, students with high and low mathematical efficacy can write down the final results and provide reasons for the conclusions drawn. Meanwhile, in the aspect of self-regulation, students with high and low mathematics efficacy have conducted a review. Therefore, understanding students' critical thinking is very important for students and teachers to improve students' ability to solve PISA problems.

Keywords: Critical Thinking, PISA Problem Algebra Content, Mathematics Efficacy

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan berpikir kritis siswa pada masalah PISA konten aljabar ditinjau dari efikasi matematika tinggi dan rendah. Penelitian ini merupakan penelitian deskriptif kualitatif yang melibatkan dua siswa SMP dengan efikasi matematika tinggi dan rendah di salah satu SMP di Kabupaten Jombang. Teknik pengumpulan data dilakukan dengan pemberian angket efikasi matematika, tes pemecahan masalah PISA konten aljabar, dan pedoman wawancara. Analisis data berdasarkan indikator kemampuan berpikir kritis (interpretasi, analisis, evaluasi, inferensi, eksplanasi, dan regulasi diri). Dari hasil analisis data, berpikir kritis dalam aspek interpretasi menunjukkan hanya siswa dengan efikasi matematika tinggi yang dapat menuliskan apa yang diketahui dan ditanyakan. Begitupun dalam aspek analisis menunjukkan bahwa hanya siswa dengan efikasi matematika tinggi yang dapat membuat model matematis dari soal yang diberikan. Pada aspek evaluasi, siswa dengan efikasi matematika tinggi dan rendah dapat menuliskan penyelesaian soal secara lengkap. Begitupula dengan aspek inferensi, siswa dengan efikasi matematika tinggi dan rendah mampu menarik kesimpulan secara logis. Bagitu juga aspek eksplanasi, siswa dengan efikasi matematika tinggi dan rendah dapat menulis hasil dan memberikan alasan untuk kesimpulan. Sedangkan pada aspek regulasi diri, siswa dengan efikasi matematika tinggi dan rendah telah melakukan tinjauan ulang. Oleh karena itu, pemahaman berpikir kritis siswa sangat penting bagi siswa dan guru untuk meningkatkan kemampuan siswa dalam menyelesaikan masalah PISA.

Kata kunci: Berpikir Kritis, Masalah PISA Konten Aljabar, Efikasi Matematika

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Introduction

Thinking is a cognitive activity that occurs when a person is faced with a problem that must be solved. One type of thinking used to solve problems is critical thinking. Critical thinking is a process directed at the following mental activities: solving problems, making a decision, persuasion, analysis of opinions or hypotheses, and carrying out science research (Johnson, 2009). Furthermore, according to Amir, critical thinking is a kind of mental activity in which a person collects, classifies, analyzes, and evaluates information or evidence to conclude to solve certain problems (Syafruddin & Pujiastuti, 2020). In line with this opinion, critical thinking is goal-directed thinking that involves decision-making, explanation, or problem-solving (Basri et al., 2019). Critical thinking is a crucial component that every student needs to master because the process of critical thinking is one that depends on how to conclude what to do and helps individuals evaluate when making decisions, as Permendikbud No. 21 of 2016 concerning Mathematics Competencies requires students to think logically, analytically, critically, creatively, carefully and thoroughly in solving the mathematical problems, responsive, responsible, and not easily giving up (Sandra & Werdiningsih, 2021).

The core of critical thinking involves indicators such as interpretation, analysis, evaluation, inference, explanation, and self-regulation (Facione, 2011). Researchers chose the indicators put forward by Facione because they are by the definition of critical thinking abilities referred to in this study, namely the ability to think critically in problem-solving and based on cognitive skills and abilities. In line with this, it is necessary to increase students' critical thinking by providing challenging problems for students to solve (Buskist & Irons, 2008). In addition, according to Pratiwi, learning is easier and more meaningful if the content learned is related to phenomena or problems in everyday life (Satiti et a1., 2021). Therefore, challenging problems need to be presented contextually, namely in the form of problems that arise in students' daily lives, one of which is the PISA model problem in mathematics.

The Program for International Student Assessment (PISA) model is an international assessment of the skills and abilities of students under the age of 15 by the Organization for Economic Co-Operation and Development (OECD). The performance assessment is conducted over one semester covering mathematics, reading, and science. Indonesia scored 73rd out of 78 nations in the 2018 PISA survey, with an average math score of 379. (Schleicher, 2019). This shows that Indonesia has a low average score in math. Thus, students' critical thinking abilities are needed to be able to solve problems in the form of problem-solving such as test questions on PISA.

PISA model math problems are mathematical problems adapted from PISA math problems (Baiduri et al., 2020). Students should be given math problems based on the PISA model to encourage students' critical thinking. Korres & Tsami (2010) show that the use of mathematical problems in the PISA model contains high standards of thinking skills that can lead to critical thinking in students. In line with this statement, research conducted (Hasan, 2019) shows that the PISA model math problems encourage students to use various basic mathematical abilities including critical thinking when solving these problems.

PISA model problems are developed based on four contents, four of which include: shape and space content, change and relationship content, quantity content, and uncertainty content (She et al., 2018). According to Stacey, judging from the results of the PISA data, the most difficult problem is in the change and relationship content (Pranitasari & Ratu, 2020). This content is related to the topic of Algebra. This is the basis that researchers will focus on the mathematical problems of the algebra content PISA model. According to Suhaedi, algebra is a very important material for students because algebra is used both implicitly and explicitly in everyday life (Maharani et al., 2019). In solving an algebra problem, students can apply systematic steps, namely, (a) classifying sentences; b) identifying the factors of the case under consideration; c) concluding; and (d) writing the results (Murtiyasa et al.,

2020). This indicates that this material is closely related to critical thinking. Therefore, students must understand algebra material so that they know it and can apply it in everyday life.

Critical thinking in problem-solving can be influenced by several factors, one of which is students' confidence and behavior toward mathematics or commonly referred to as self-efficacy. According to Bandura, self-efficacy is a person's feeling that they are capable of organizing and executing the series of actions necessary for achieving their own specific task. (Sukma & Priatna, 2021). In addition, according to Barni et al (2019), a belief in the ability of an individual to perform specific tasks or responsibilities is self-efficacy. Therefore, students' self-efficacy is very important to develop in learning because it can increase students' enthusiasm and performance in dealing with tasks (Turay et al., 2021).

Mathematics efficacy is understood as students' self-confidence in solving certain mathematical problems and mathematical tasks well (Ayuningsih & Dwijayani, 2019). In addition, math efficacy can determine students' difficulties in learning mathematics (Ardi et a1., 2019). It is often encountered that students are not confident in their mathematical abilities. When students do not understand the material well and perceive math as a difficult subject, they quickly give up before starting to work on problems that are slightly more difficult than the previous problems. In line with this, the research findings of Ningsih & Hayati (2020) found that math efficacy is a significant factor in determining individual math achievement, especially when completing tasks in the form of problem-solving questions.

Sukma & Priatna (2021) indicates that there are two types of self-efficacy, high and low self-efficacy. In line with that, individuals with high mathematical efficacy will choose to exert greater effort and be more persistent in solving math problems than those with low mathematical efficacy (Salsabilah & Kurniasih, 2022). Someone with high mathematical efficacy easily generates motivation to learn, beliefs in their abilities, does not give up easily in finding solutions, and can manage and develop their efforts in various situations. Meanwhile, students with low mathematics efficacy believe that they cannot complete all tasks in learning (Ningsih & Hayati, 2020). This can certainly make math efficacy a consideration in influencing students' critical thinking toward solving maths.

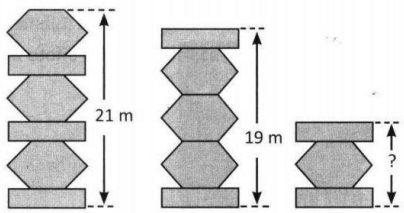
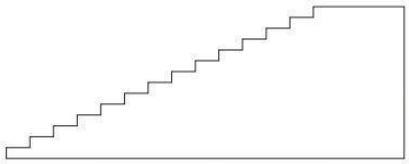
Research conducted by Ningsih & Hayati (2020); Sukma & Priatna (2021); Sandra & Werdiningsih (2021) describe mathematical critical thinking in terms of self-efficacy but are not limited to mathematical efficacy. Therefore, this research will focus on students' mathematical efficacy. Based on the above description, it is necessary to examine how the profile of students' critical thinking in solving PISA problems in algebraic content in terms of high and low mathematical efficacy. So, this research is titled "Critical Thinking of Students with High and Low Mathematics Efficacy PISA Problem: A Case of Algebraic Task".

Method

Descriptive research employing qualitative approaches is used in this type of study. This research describes students' critical thinking in solving PISA problems on algebra content in terms of mathematical efficacy. The subjects taken in this study were two junior high school students, namely students with high and low math efficacy. This selection is based on the consideration that the subjects who have studied algebra material before

Two instruments were used in this study: the researcher acts as the main instrument while the supporting instruments use a math efficacy questionnaire sheet, Algebraic Content PISA Problems (ACPP), and interview guidelines. This interview guideline is needed to explore information about what is in the minds of students and has not been written in the results of student work.

Table 1. Algebraic Content PISA Problem Test Questions

No.	Algebraic Content PISA Problems (ACPP)
1.	"Below are 3 towers that have different heights and are composed of 2 shapes, a hexagon, and a rectangle. What is the height of the shortest tower?" 
2.	"Take a look at the ladder diagram below! The diagram below shows a staircase with 14 steps and a height of 252 cm. How tall is each of the 14 levels?" 
3.	"Peter's bicycle tire has a circumference of 96 cm. If the ratio between the number of revolutions of the tire and the three gears of his bicycle (small gear, medium gear, and large gear) is:

Gir Size	Gir Round	Tire rotation
Small	3	1
Medium	6	5
Large	1	2

How many revolutions of the medium gear of Peter's bike does it take to cover a distance of 960 meters? Write down your answer!" |

Adaptation of PISA Released Items-Mathematics, OECD

The three questions above are PISA questions on the content of change and relationships and are included in algebraic material with different contexts. Problem number 1 describes that the problem is made by using the concept of comparison to determine the shortest tower height. This problem uses the context of "tower" and is level 4 which shows the mathematical competence achieved by students.

Problem number 2 describes that the problem is made by using the concept of comparison to determine the height of each step of the ladder. This problem uses the context of "stairs" and is level 2 which requires students' ability to relate one or more mathematical concepts to the information in the problem.

Problem number 3 describes that the problem is made by using the concept of comparison to determine the number of times the bicycle's medium gear is needed to cover a certain distance. This problem uses the context of "bicycle" and is level 3 which requires sequential decisions and applying simple problem-solving strategies by interpreting using representations of information sources.

Table. 2 Interview Guidelines

No.	Indicator	Description	Question Description
1.	Interpretation	Can succinctly describe known problems.	What information did you get after reading the problem? (known and questionable information)

2.	Analysis	Can make a mathematical model of the given problem correctly	Explain the relationship between the known information and the way you know how to solve the problem!
3.	Evaluation	Can write the solution to the problem precisely and completely	How did you solve the problem? Explain each step of the solution that you have done!
4.	Inference	Can conclude what is asked logically	From the problem given, what conclusion do you think you drew?
5.	Explanation	Can write down the final result and give reasons for the conclusion drawn	From the conclusions you drew, what were the results obtained?
6.	Self-Regulation	Can review appropriately according to the context of the problem	Did you double-check every step of your solution?

Adaptation from Fithriyah, et al (2016)

The data collected in this study was obtained through the selection of research subjects, who had high and low mathematics efficacy. The determination of the subject was obtained by first giving a mathematics efficacy questionnaire sheet to ninth-grade students at a junior high school in Jombang Regency to determine the level of students' mathematics efficacy adapted from research conducted by Kurniawati (2019). Then the data will be analyzed using the mathematics efficacy score guidelines. Then, the classification of levels of mathematics efficacy is based on Table 3 below:

Table 3. Classification of Students' Mathematics Efficacy

Category	Score
High	$50 < \text{score} \leq 100$
Low	$0 \leq \text{score} < 50$

Based on the results of the categorization above, 2 students were selected to be used as research subjects, namely students with high and low mathematics efficacy with the criteria of having the same gender, fluent and open in oral communication, and having relatively the same mathematics ability. This math ability is measured from the last report card math score obtained by students. Students from the high math efficacy category were coded SET1 while students with low math efficacy category were coded SER2.

Then the two selected subjects will work on the ACPP sheet to identify students' critical thinking in solving mathematical problems of the PISA model of algebra content. Students' ACPP answer sheets were analyzed using the researcher's answer key and adapt to the achievement of Facione's critical thinking indicators. Then the interview stage was carried out using the researcher's interview guidelines. Furthermore, each research subject will be described in its critical thinking profile in completing the PISA model math questions.

Analysis of research data is done by summarizing data, presenting data, and forming conclusions. Triangulation is one method for determining the credibility of data (Sugiyono, 2013). The triangulation used is a triangulation of techniques including interviews, observations, and subject work.

Result and Discussion

The classification of students at two levels of mathematics efficacy with consideration of additional categories, namely students having relatively similar mathematics abilities and having similar gender to obtain research subjects. The selected subjects were then given the ACPP. The following are

the details of the students selected as research subjects:

Table 4. Research Subjects

Student Name	Gender	Math Efficacy Questionnaire Score	Math Efficacy Levels	Math Proficiency Score	Subject Code
C.S.F.	Female	64	High	85	SET1
V.A.P.	Female	48	Low	83	SER2

The following are the findings of the researcher's investigation of the critical thinking profile of students. based on Facione's (2011) indicators of mathematical efficacy based on ACPP findings investigation and interviews:

Critical Thinking Profile of Students with High Mathematics Efficacy

Interpretation Aspect

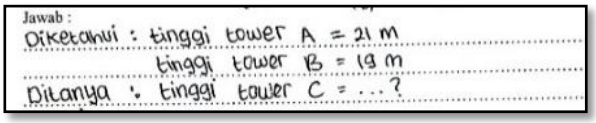


Figure 1. SET1's answer to Question 1

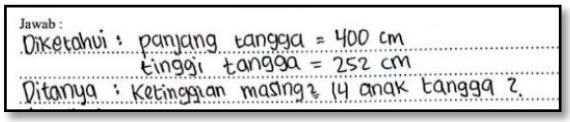


Figure 2. SET1's answers to Question 2

The following are excerpts of interviews with SET1 regarding the interpretation aspect:

PSET1 : "Try to tell me in this preprocessing *what the alley information is known and asked for the three questions!*

SET1 : "Problem number 1, from the picture it is known that ***the height of tower A is*** **2m,** ***tower B is 19m, and tower C is the question.*** *For problem number 2, it is known that* ***the length of the stairs is 400cm and the height of the stairs is 252cm*** while **the** ***height of each of the 14 steps is asked.****"*

Based on the ACPP answers and SET1 interview results in the interpretation aspect, it shows that SET1 can write what is known and asked from the three problems. This is shown in number 1, SET1 can write what is known, namely the height of each tower and what is asked is the shortest tower height. In number 2, SET1 can write what is known, namely the length and height of the stairs and what is asked is the height of each step. In number 3, SET1 can write what is known, namely the circumference of the tire, the rotation of the gear and the medium tire and what is asked is the number of times the medium gearis rotated to cover a certain distance.

Analysis Aspect

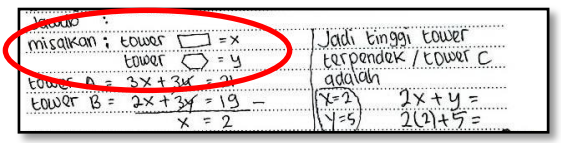


Figure 3. SET1's answer to Question 1

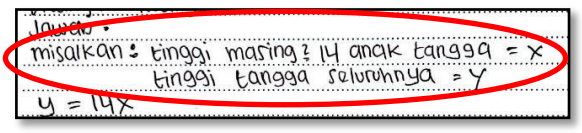


Figure 4. SET1's answers to the Question 2

The following are excerpts of interviews with SET1 regarding the analysis aspect:

PSETI : "From the known and questions that you have mentioned earlier, explain the connections between the known information and the way to solve the problem that you know!"

SETI : "To solve the problem **I** ***used equations****, for number 1* ***the square image*** **I** ***let x and the hexagon image I let y*** *and then* I *solved it with* elimination and substitution. *For number* 2, ***I also assumed the height of each of the*** **14** ***steps is x and the height of the entire staircase is y****"*

Based on the ACPP answers and SET1 interview results in the analysis aspect, this shows that a correct mathematical model of the problem can be produced by SET1. This is evidenced by the solution steps taken by SET1 by memorizing the variables (x,y) and then solving them.

Evaluation Aspect

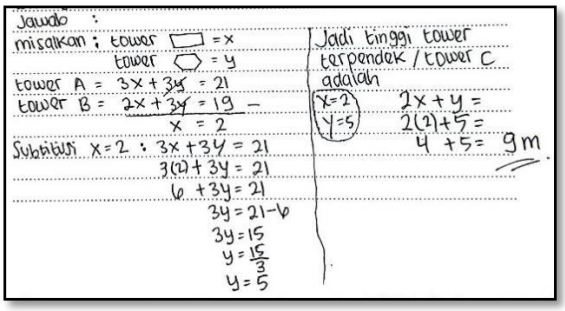


Figure 5. SET1's answer to Question 1

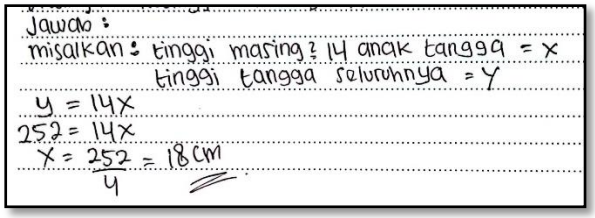


Figure 6. SET1's answer to Question 2

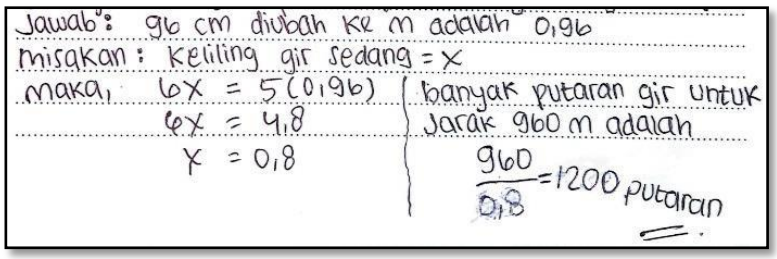


Figure 7. SET1's answer to Question 3

The following are excerpts of interviews with SET1 regarding the evaluation aspect:

PSET1 : "After you generalize, *how do you solve the three problems?"*

SETI : "With that equation, I thought of solving it by ***eliminating y first and then getting the value of x = 2 and then substituting it.*** *For number 2 because what was asked was the height of each stair* ***so I just divided it,*** *while for number 3 I thought* ***the ratio was 6:5 so it was solved like this****"*

Based on the ACPP answers and SET1 interview results in the evaluation aspect, it shows that SET1 can write the problem-solving correctly. This is evidenced in problem number 1, SET1 can write the solution to the problem using the elimination and substitution methods. In problem number 2, SET1 was able to write the solution by dividing the height of the stairs by the number of steps. In question number 3, SET1 can write the solution by comparing the rotation of the gear and medium tires.

Inference Aspect

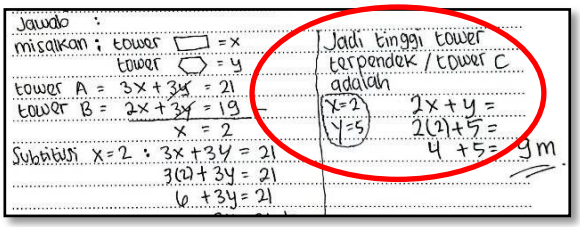


Figure 8. SET1's answer to Question 1

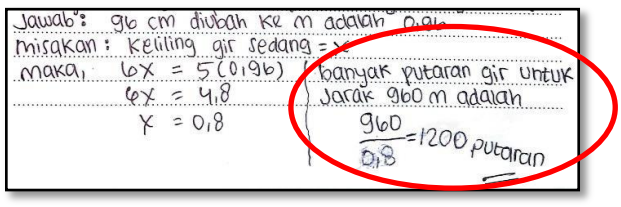


Figure 9. SET1's answer to Question 3

The following are excerpts of interviews with SET1 regarding the inference aspect:

PSET1 : "What can you conclude from the solution that you explained earlier?"

SET1 :"For question number 1 ***after was substituted into 2x + y, which is the shortest tower, the the result was 9m.*** *While number 3 I thought by* ***dividing 960 by 0.8 I found 1200 turns****"*

Based on the ACPP answers and SET1 interview results in the inference aspect, it shows that SET1 can draw logical conclusions. This is evidenced by the solution taken by SET1 from the permutation to the conclusion is correct. In question number 1, SET1 can conclude that the shortest tower height is 9m. Likewise in question number 2, the height of each step is 18cm. While in question number 3, SET1 concluded that the number of turns of the medium gear for a distance of 960m is 1200 turns.

Explanation Aspect

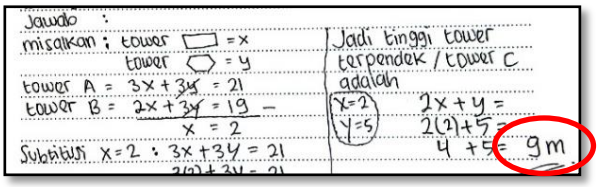


Figure 10. SET1's answer to Question 1

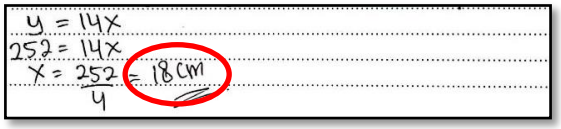


Figure 11. SET1's answer to Question 2

The following are excerpts of interviews with SET1 regarding the explanation aspect:

PSET1 : "From your conclusion, what is the final result that can be obtained?"

*SET1 : "After I finish it, I get for **number 1 is 9m**, **number 2 is 18 cm**, and **number 3 is 1200 turns**."*

Based on the ACPP answers and SET1 interview results in the explanation aspect, it shows that SET1 can write the final results and provide further explanations of the conclusions that have been made.

Self-Regulation Aspect

The following are excerpts of interviews with SET1 regarding the self-regulation aspect:

PSET1 : "Have you rechecked the steps of the solution you did?"

*SET1 : "Yes, **I have checked everything**"*

PSET1 : " Can you be certain that your answer is correct?"

*SET1 : "**Of course**"*

Based on the SET1 interview results in the self-regulation aspect, SET1 has thoroughly reviewed the results of problem-solving from start to finish.

Critical Thinking Profile of Students with Low Mathematics Efficacy

Interpretation Aspect

Based on the ACPP answers and SER2 interview results in the interpretation aspect, what we know and what we ask from both of these problems has not been documented by SER2. Instead, SER2 directly applied the solution plan to the given problem.

Analysis Aspect

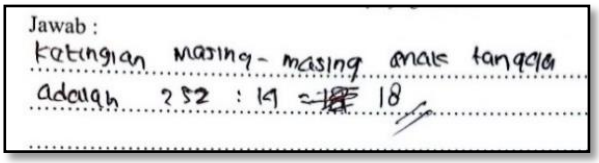


Figure 12. SER2's answer to Question 2

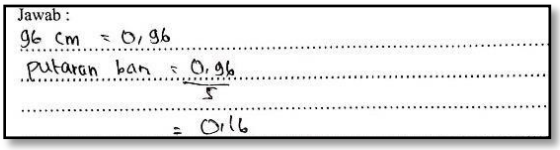


Figure 13. SER2's answer to Question 3

Based on the ACPP answers and SER2 interview results in the analysis aspect, the problem has not been made a mathematical model by SER2. This is shown by SER2's answer which does not use the variables to solve the three problems.

Evaluation Aspect

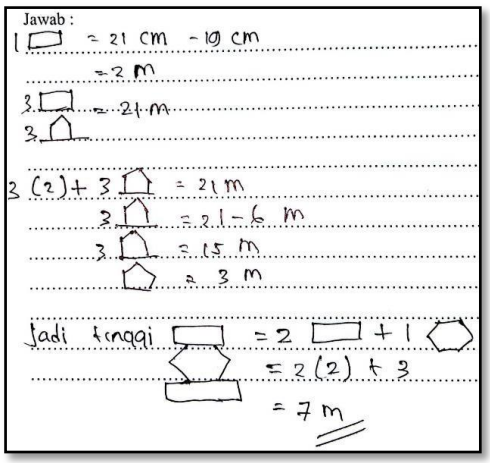


Figure 14. SER2's answer to Question 1

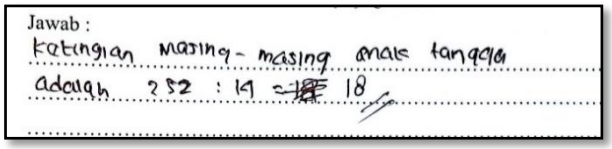


Figure 15. SER2's answer to Question 2

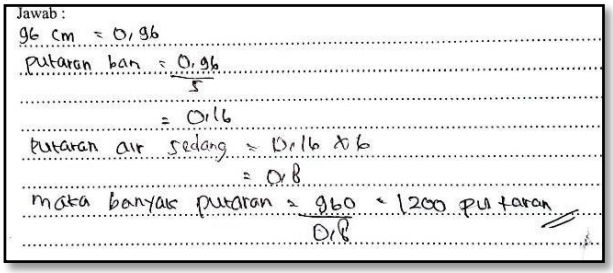


Figure 16. SER2's answer to Question 3

The following are excerpts of an interview with SER2 regarding the evaluation aspect:

PSER2 : "How did you solve the three *problems*?"

SER2 : "For question number 1, ***I calculated each of the shapes first. Then I found the rectangle is 2 and the hexagon is 3 and then I substituted.*** *If number 2* ***is just divided, so 252 is divided by 14*** *will find the answer. Number 3 I think because* ***the ratio is 6:5 so I solve it by calculating the tire rotation divided by 5 because the ratio is 5, then multiplied by 6****"*

Based on the ACPP answers and SER2 interview results in the evaluation aspect, it shows that SER2 can write the problem-solving completely and correctly. However, for number 1, the solution given is not correct. This is due to an error in the representation of the shape. Meanwhile, in problem number 2, SER2 was able to write the solution by dividing the height of the stairs by the number of steps. In problem number 3, SER2 can write the solution by comparing the rotation of the gear and the medium tire.

Inference Aspect

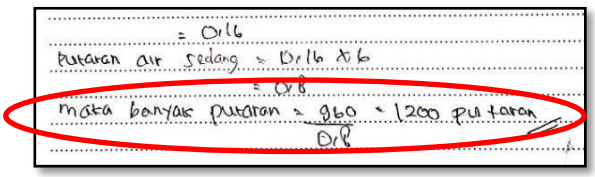


Figure 17. SER2's answer to Question 3

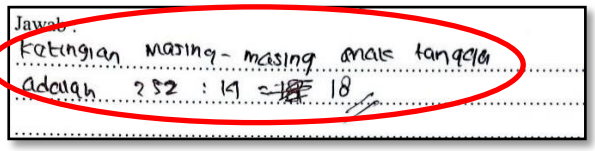


Figure 18. SER2's answer to Question 2

The following are excerpts from the interview with SER2 regarding the inference aspect:

PSER2 : "What can you conclude from the solution that you explained?

SER2 : "Number 2 is ***252 divided by 14 and 18,*** *while number 3 is with dividing* ***960*** *by* ***0.8*** *yields* ***1200*** *portions"*

Based on the ACPP answers and SER2 interview results in the inference aspect, it shows that SER2 can conclude what is asked logically. This is proven by the solution taken by SER2 from the beginning to the conclusion is correct. In question number 1, SER2 can conclude that the shortest tower height is 7m although the solution taken is not correct. Likewise, in question number 2, the height of each step is 18cm. While in question number 3, SER2 concluded that the number of medium gear rotations for a distance of 960m is 1200 rotations.

Explanation Aspect

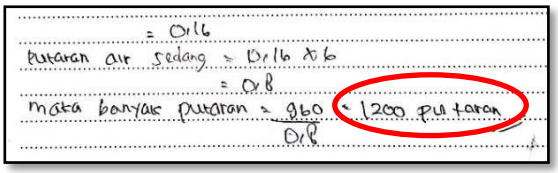


Figure 19. SER2's answer to Question 3

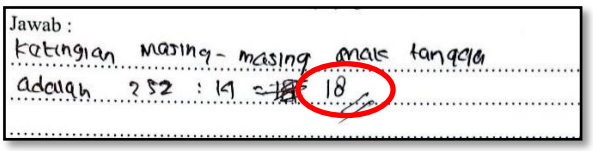


Figure 20. SER2's answer to Question 2

Based on the ACPP answers and SER2 interview results in the explanation aspect, it shows that SER2 can write the final result and give further explanation to the conclusion that has been made.

Self-Regulation Aspect

The following are excerpts of interviews with SET1 regarding the self-regulation aspect:

PSET1 : "Have you rechecked the steps of the solution you did?"
*SET1 : "**Yes**"*
PSET1 : " Can you be certain that your answer is correct?"
*SET1 : "**Of Course**"*

Based on the SER2 interview results in the self-regulation aspect, SER2 has thoroughly reviewed the results of problem-solving from start to finish.

Based on the research findings adjusted to Facione's (2011) critical thinking indicators in solving PISA algebra content problems, students with high mathematics efficacy can (1) Write down what is known and asked from the three problems (interpretation aspect), (2) Create a mathematical model of the problem given (analysis aspect), (3) Write down the exact problem solving (evaluation aspect), (4) Conclude what is asked (inference aspect), (5) Write down the final results and provide an explanation for the conclusions that have been made (explanation aspect), (6) Review the results of problem-solving thoroughly from start to finish (self-regulation aspect). This is also consistent with the research of Sukma & Priatna (2021); Salsabilah & Kurniasih (2022) that students with high mathematics efficacy have excellent mathematical critical thinking skills in analyzing, identifying problems, and connecting concepts, solving problems, and evaluating the problems given so that they can meet all indicators.

Meanwhile, students with low mathematics efficacy can (1) Write down the problem-solving appropriately (evaluation aspect), (2) Draw conclusions from what is asked (inference aspect), (3) Write down the final results and provide an explanation for the conclusions that have been made (explanation aspect), (4) Review the results of problem-solving thoroughly from start to finish (self-regulation aspect). However, students with low math efficacy cannot write down what is known and asked from the three problems (interpretation aspect) and create a mathematical model of the problem given (analysis aspect). This is also consistent with the research of Ningsih & Hayati (2020) and Hidayat & Noer (2021) which suggests that the ability to solve problems is weaker for students with low math efficacy.

Based on the findings of the study, it can be said that mathematical efficacy has a great influence on students' critical thinking skills. This is in line with Nurazizah & Nurjaman (2018) also stated that

there is a significant relationship between mathematical efficacy and students' critical thinking skills, where the higher the mathematical efficacy of students, the higher their mathematical critical thinking skills. The results also indicate that math efficacy affects mathematics learning, especially in solving a PISA math problem. In order to enhance comprehension and problem-solving skills regarding PISA problems, it is crucial for educators and pupils alike to possess knowledge of the critical thinking abilities of students. This understanding can allow for more efficacy and significant training in mathematics, tailored to the individual capabilities and potential of each student.

Conclusion

After analyzing the research findings and conducting discussions, a conclusion can be derived regarding the identification of critical thinking profiles of junior high school students in relation to their efficacy in mathematics. Specifically, this conclusion pertains to their performance on PISA problems, which involve algebraic content and can be categorized into high and low levels of efficacy. Students with high mathematics efficacy can fulfill all of Facione's critical thinking indicators. It also shows that students with high mathematical efficacy can solve problems well. In addition, students with low mathematics efficacy only fulfill four indicators (evaluation, inference, explanation, and self-regulation). However, students with low mathematics efficacy could not fulfill the indicators of interpretation and analysis. According to the findings of this study, it can be deduced that students who possess a greater level of mathematical efficacy are more adept at employing critical thinking skills when faced with problem-solving tasks.

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