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Thinking Process Analysis Reflective Student in Solve Problem Non-routine On Probability Material

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ABSTRAK

The problem faced by students in school is the lack of a thinking process that is able to link existing knowledge with problems that are rarely encountered before. The reflective thinking process is one of the important aspects in solving non-routine problems and can be viewed from students' mathematical abilities. Therefore, this study aims to describe the reflective thinking process of class XI IPA 1 students of SMAN 10 Makassar with high initial mathematical abilities in solving non-routine mathematical problems. This study is a descriptive study using a qualitative approach. The results obtained in this study are that students with three subjects with high initial mathematical abilities have a reflective thinking process in four problem-solving steps (polya) as follows (1) understanding the problem: (a) elaborative-creative thinking, (b) clarification-critical thinking, (c) critical-assessment thinking and (d) creative-laboratory thinking, all indicators are met by all subjects. (2) developing strategies: (a) inferential-critical thinking, (b) elaborative-creative thinking and (c) fluent-creative thinking, all indicators are met by all subjects except for the fluency indicator, there is one subject that does not meet it. (3) implementation strategy: (a) inferential-critical thinking is fulfilled by the subject, (b) flexible-creative thinking, only two subjects fulfill the indicators and (d) originality-creative thinking can only be fulfilled by one subject. (4) looking back: (a) elaborative-creative thinking and (b) critical thinking strategy, all indicators are fulfilled by the subject, but only one student checks the answer.

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Pendahuluan

Mathematics is knowledge knowledge that can play a role to finish human problems face it with utilise ability think logical, creative, critical, objective, and analytical (Tisngati, 2015).

Role mathematics the found in learning at schools that have objective among them namely so that students own understanding breakdown problem . With thus, for meet the target of objective learning said, then needed a meaningful and capable learning to increase activity students who ultimately will increase ability understanding student (Asmaun, 2024). However, according to Suwasti (2016), facts that occur in learning mathematics in school show that contribution given to increase ability student in solve problem . Activity Study teach mathematics considered limited to activities cognitive, namely student given Exercise using theoretical questions with various use formula. During This student Still fixated on activities memorize formula so that they can do questions given. Completion from given problem considered only Can completed with memorize existing formula. In fact, this that Not yet of course Can realized. Quality think somebody measured to reach ability think level height which is one of the from the target achievement in learning mathematics (Adha & Rahaju, 2020). Because of that that, it is necessary to learn student to finish problem mathematics so that ability think student need developed.

Skills think become things needed student in learn various matter specifically mathematics. As a result, no surprising If ability think considered as size success in learning mathematics, especially in matter ability think level high (Noviyanti et al., 2021). Through skills good thinking, students can understand problem the mathematics (Baharuddin, 2024). In addition, it is expected that student reach good conclusion (Lutfiananda, 2016). One of ability supportive thinking skills breakdown problem student in learning mathematics is reflective thinking. Suwartia & Syaiful (2023) explain that ability reflective thinking is ability to merge knowledge new with knowledge that has been studied previously saved in memory so that can find solution for problem. While Wulansari et al. (2019) add that reflective thinking interpreted as activity think student in a way active in connect knowledge that ever obtained in finish problem to get conclusion. Dewey (1910) to name matter the with the term " thinking "reflective ". In terms of this is the process that is carried out No just a order from ideas, but a sequential process such that so that each idea refers to the previous idea to determine step next. With thus, all step sequentially, mutually connected, interconnected support One each other and play a role to going to more conclusions carry on.

Gurol (2011) define reflective thinking as a process of activity directed and precise namely student realize, analyze, evaluate, motivate, get deep meaning, using appropriate learning strategies in the learning process itself. This matter in line with Skemp's (Nasriadi, 2016) opinion to put forward that reflective thinking can depicted as a process of thinking that responds problem with use information or data originating from from in self (internal), can explain what has been done, fix errors found in solve problems, and communicate ideas with symbol no with picture or object direct. With thus through the process of thinking reflective can known student process in solve a problem in a way more deep, because the thinking process reflective no just demand answer from a problem but also concepts, facts and logical reasons, as well as taking rational decision in every process of solving problem that is done. Thinking reflective is very important to evaluate the learning process alone specifically in solve problem. In line with opinion from Kholid et al. (2020) state that Reflective thinking starts from individuals experiencing confusion and evaluation to find a solution to the problem. While that, teachers need knowing the thinking process reflective student to obtain information about error encountered student so that can help in repair quality learning (Lutfiananda, 2016).

Reflective is crussial for students and teachers. However, this this is very different with facts on the ground, that reflective thinking not yet be one of objective learning mathematics in school (Lutfiananda, 2016). That matter in accordance with findings Suwartia & Syaiful (2023) that ability reflective thinking on learning mathematics in school Still not enough get attention. This can seen from low results test student in finish problem mathematics, more carry on, Suharna et al. (2013) report that in learning mathematics, thinking reflective not enough get

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teacher's attention. Sometimes teachers just notice results end from settlement problem solved students, without notice how student to finish problem. If the answer student different with key answer, usually the teacher directly blame answer student the without to browse Why student answer thus.

In addition, the low ability reflective thinking is also listed in the study introduction made by Nindiasari et al. (2014) to a number of High school students in Tangerang in 2010 received a number of The findings include: (1) teachers are more LOTS give formula, concept mathematics that has been ready used and not invite student think to find formula and concept the mathematics he studied, (2) almost more from 60% of students not yet capable finish task reflective thinking mathematical, for example task interpret, relate, and evaluate. A part from paying attention to ability reflective thinking, teachers also need notice ability beginning mathematics student moment solve problem mathematics. Because according to Lutfiananda (2016) difference ability beginning mathematics allow the occurrence difference understanding material and impact on skills thinking and solving problem students. This is in line with opinion Suwartia & Syaiful (2023) that state that when solve problem, every individual own characteristics typical that is not owned by individuals other. Besides that according to Yuni et al. (2021) that the increase in students' mathematical reflective thinking abilities who received problem-based learning was significantly better than students who received conventional learning when viewed from students' initial mathematical abilities. It can interpreted that every individual different one with others and Suharna (2012) add that students who have background back and ability mathematics different, also has different abilities in breakdown problem. Ability beginning mathematics student differentiated become three group, namely group ability hight, medium, and low.

To know how far is the understanding student to a material involving ability reflective thinking students, then a teacher needs to do capable activities dig ability such as solve problem mathematics. This is in line with opinion Noviyanti et al. (2021) that state that to know how much big ability reflective thinking students, then a educator must do a series activities that can make student show ability reflective thinking students. So the solution problem as a process for find combination from a number of rules that can applied to overcome new situation. This explained more continued by Suwartia & Syaiful (2023) that solution problem no just form capable in apply the rules that have been mastered through past learning, but more from That namely is a process for get a set more rules high level the rules. In addition Hartati et al. (2020) to put forward that mathematical reflective thinking skills are important to be developed in students because the results of learning activities and problem solving will be proportional to the reflective thinking skills possessed by students. Therefore, reflective thinking and problem solving skills in mathematics learning need to be mastered and honed to support the learning process of students (Syadid & Sutiarso, 2022)

Polya proposed a four-step problem solving phase namely understanding the problem, planning a solution, completing it problem and recheck all the steps that have been taken done. Polya's opinion which states that there are four steps in the problem solving approach, namely: (1) Understanding problem, at this stage, activities breakdown problem designed For help student determine what they know about problems and questions raised. To help student understand problem this , some question must submitted. Questions the including : what you know about question ? what is being asked ? and do you need it? all information? (2) Planning a solution, Without good planning, the problem solving method will not work. During problem solving planning, students are trained to find the right problem solving method to solve the problem. To help students plan a solution, the following questions arise: Have you ever encountered a similar problem before? Which formula can be used for this problem? Pay

attention to the question? Is the approach related to the problem to be solved? (3) Implement the plan The next process is to solve the problem according to what has been planned if the students have understood the problem well and found a way to solve it. The students' ability to understand the material and mathematical calculation skills will greatly help them in completing this stage. (4) Rechecking, the last step of The method of solving mathematical problems is to recheck the answers produced. This step is very important to do to find out whether the results obtained are in accordance with the provisions and there is no contradiction with what is asked. This important step can be used as a guideline for carrying out this step, namely matching the results that obtained with the question and check the correctness of the solution. Based on the previous description, it can be concluded that mathematical problem solving is a student's effort to solve the problems they face by using mathematical concepts and skills by involving the knowledge and learning experience they have when the solution or method of solving is not yet clear.

Give problem non-routine to student means practice they apply various draft mathematics in situation new so that in the end they capable use various draft the science that has they learn to solve problem in life everyday . Like as it is according to Kholid et al. (2020) that Giving questions that are unfamiliar to students can cause confusion and encourage them to apply their knowledge and experience to solve them. Therefore, it is very appropriate for exploring students' reflective thinking. So the problem non-routine this is what can used as question breakdown problem. Solution problem in teaching mathematics can interpreted as use various concepts, principles, and skills mathematics that has been or currently studied to finish problem non-routine (Wahyudi & Budiono, 2012). Therefore that, it is recommended to the teacher for get used to student reflective thinking through non-routine and strengthening questions draft mathematics for make it easier student in finish problem the mathematics he encountered (Febrianty et al., 2024). The characteristics of non-routine problem solving in this study were adapted from Polya's steps that have been formulated by Lutfiananda (2016). The steps of problem solving characteristics are further clarified in order to obtain more detailed and in-depth information, so that the information obtained is not only on strategies or solutions but also ways of thinking, difficulties or other processes that may occur. The criteria of non-routine mathematical problem solving are shown in Table 1.

Table 1. Criteria of Solving Non-Routine Mathematical Problems

Step	Description	Indicator
Understanding the problem	Read the non-routine problems given and understand their meaning	Able to explain in own words the problems given.
	Identify information or conditions that have been met or not met from the question.	a. Able to determine the conditions or information contained in the given problem. b. Able to determine the conditions and information that is and is not available in a given problem. c. Able to determine information that is not relevant to the given problem.
	Identify what is being asked from the given problem	a. Able to determine the things asked in the given problem. b. Able to establish the relationship between one piece of information and other information with what is being asked in the problem.
Designing a strategy	Develop a problem-solving plan or strategy.	Can relate information obtained in previous stages or from experience to develop problem-solving strategies as a guideline in solving problems.
Execute the strategy.	Implement the problem solving strategies that	a. Able to apply problem solving strategies that have been prepared with correct mathematical and computational concepts to obtain solutions.

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Step	Description	Indicator
	have been prepared to obtain a solution.	b. Can apply problem solving strategies that have been prepared to answer all questions in the problem by using all available information or conditions.
Check back	Recheck every problem solving step that has been implemented.	a. Can demonstrate the suitability of problem-solving steps with existing information or requirements and the strategies that have been developed. b. Can demonstrate the suitability of the problem-solving solution obtained with the information or conditions known and asked. c. Can find alternative problem-solving strategies using existing information.

Based on the definition of the reflective thinking process and the criteria of solving non-routine problems previously, the characteristics of the reflective thinking process in problem solving were obtained. The characteristics of the reflective thinking process in solving non-routine problems in this study were developed from the characteristics formulated by Lutfiananda (2016) This is done so that the information obtained can be described more completely and systematically. The characteristics of the reflective thinking process of solving non-routine mathematical problems in this study are shown in Table 2.

Table 2. Characteristics of Reflective Thinking Processes in Solving Non-routine Problems

Step	Troubleshooting Indicators	Reflective Thinking Process
Understanding the problem	a. Can restate the given problem in your own words. b. Can determine information or conditions that have been met from the given problem. c. Can determine information or necessary conditions that are still not met from the given problem. d. Can determine unnecessary information from a given problem. e. Can determine the goals to be achieved from the given problem. f. Can determine the relationship between known information and the goals to be achieved.	*Identifying the Problem* a. Stating the problem in your own words or through symbolic representation carefully and in detail (*Elaboration* - Creative Thinking). b. Identifying the given facts clearly and logically (*Clarification* - Critical Thinking). *Analyzing the Problem* c. Find important question in question based on required information . (*Assessment* - Critical Thinking). d. Determine the information needed and that which is still lacking, accompanied by logical and clear reasons (*Assessment* - Critical Thinking). e. Connecting the information obtained with existing knowledge to understand the situation (*Elaboration*- Creative Thinking).
Designing a strategy	Can find out information obtained in the previous stage or from experience to develop problem-solving strategies as a guideline in solving problems.	*Determining Criteria* a. Representing problems in symbols (*Inference* - Critical Thinking). *Analyzing Information* b. Develop problem solving strategies accompanied by logical and clear reasons (*Inference* - Critical Thinking). *Proposing Problem Solving Solutions* c. Connecting known information with existing concepts or experiences (*Elaboration*- Creative Thinking). d. Able to propose various solutions to solve problems appropriately (*Fluency*- Creative Thinking).

Step	Troubleshooting Indicators	Reflective Thinking Process
Execute the strategy.	a. Able to apply problem solving strategies that have been prepared with correct mathematical and computational concepts to obtain solutions. b. Can apply problem solving strategies that have been prepared to answer all questions in the problem by using all available information or conditions.	*Determining Problem Solving Solutions* a. Applying problem solving strategies accompanied by logical and clear reasons (*Inference* - Critical Thinking). b. Able to provide a variety of solutions appropriately (*Flexibility* - Creative Thinking). c. Able to provide different solutions or solutions that are rarely/not thought of by other students (*Originality* - Creative Thinking). *Implementing Problem Solving Solutions* d. Communicating the implementation of problem solving strategies with symbolic representation (*Inference*- Critical Thinking).
Check back	a. Can demonstrate the suitability of problem-solving steps with existing information or requirements and the strategies that have been developed. b. Can demonstrate the suitability of the problem-solving solution obtained with the information or conditions known and asked. c. Can find alternative problem-solving strategies using existing information.	*Reanalyzing* a. Connecting what has been done and what can still be done to develop problem solving that has been done (*Elaboration*- Creative Thinking). b. Distinguishing between conclusions based on valid/invalid logic (*Strategies* - Critical Thinking) c. Delivering alternative strategies or solutions to problem solving accompanied by logical and clear reasons (*Strategies* - Critical Thinking). d. Re-examine the alternative solutions provided.

Method

Research Design and subjects

This research is a descriptive study using a qualitative approach. This study describes qualitative data and is described to produce an in-depth and detailed picture of high school students' reflective thinking in solving non-routine mathematical problems reviewed from students' initial mathematical abilities. The subjects in this study were selected from students of class XI IPA 1 SMA Negeri 10. The selection of class XI students was because students were considered to have knowledge and experience in basic mathematics material, in addition, students were considered able to communicate their thoughts orally and in writing well so that efforts to explore students' reflective thinking processes could be carried out. Determination of subjects in the study used *purposive sampling technique* , which is a way of taking subjects with certain considerations. In addition, the subjects in this study were selected based on the considerations of the mathematics teacher of class XI IPA 1 of SMA Negeri 10 Makassar who referred to the criteria for selecting subjects in this study, namely having high initial mathematical abilities, being able to communicate thoughts orally and in writing well, being able to show verbal expressions when working on problems, and having sufficient knowledge and experience about basic mathematical material.

Instruments

The instruments used in this study consist of the main instrument, in this study, the main instrument in data collection is the researcher himself. Because in this study, the researcher conducted interviews to dig deeper into students' reflective thinking in solving problems in terms of students' initial mathematical abilities. Supporting instruments consist of problem-solving tests, problem-solving tests in the form of story questions. Problem-solving tests are given to research subjects which aim to assess students' reflective thinking in solving problems. The problem-solving test given to research subjects is in the form of a problem with two

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questions related to the problem given. The problem-solving test in the study is given in the following Table 3

Table 3. Problem Solving Test

The problem given	Question related problem
A school will follow race hair parry high school level or equivalent . School the will send 2 students as representative for follow race with selecting 12 students consisting of from 7 students class XI IPS and 5 students class XI science.	Mention rules What only one can used for choose students who will represent race with notice his class ! Determine all the amount method choose students who will follow race based on rule the !

Another supporting instrument is the interview guideline, in general, the questions to be conveyed in this interview activity are not structured. The questions asked are adjusted to the condition of the research subject's work results after working on the questions given. The interview guideline refers to indicators of reflective thinking designed as shown in the following Table 4.

Table 4. Interview Guidelines

Step	Troubleshooting Indicators	Interview Questions
Understanding the problem	a. Can restate the given problem in your own words. b. Can determine information or conditions that have been met from the given problem. c. Can determine information or necessary conditions that are still not met from the given problem. d. Can determine unnecessary information from a given problem. e. Can determine the goals to be achieved from the given problem. f. Can determine the relationship between known information and the goals to be achieved.	a. Have you ever encountered a problem like this before? b. Can you explain the problem in the question in your own words? Then state what is known! c. Is there any other information that is still needed to work on this problem, but is not mentioned in the problem? d. Try to mention the mathematical knowledge you have that can help solve this problem! For example, material that has been taught or formulas used.
Designing a strategy	Can find out information obtained in the previous stage or from experience to develop problem-solving strategies as a guideline in solving problems.	a. How do you plan to find a solution to the given problem? b. Why did you plan it like that? c. Are you sure about the method you are using?
Execute the strategy.	a. Able to apply problem solving strategies that have been prepared with correct mathematical and computational concepts to obtain solutions. b. Can apply problem solving strategies that have been prepared to answer all questions in the problem by using all available information or conditions.	a. How would you answer after planning a strategy beforehand? b. Is it according to your previous plan? c. How many possible rules do you think are there for selecting these two students?
Check back	a. Can demonstrate the suitability of problem-solving steps with existing information or	a. Does the answer you wrote match the written strategic plan? b. Are you sure about the answer you wrote?

	requirements and the strategies that have been developed. b. Can demonstrate the suitability of the problem-solving solution obtained with the information or conditions known and asked. c. Can find alternative problem-solving strategies using existing information.	c. How do you double check the answers you have written? d. Is there any other way besides the one you mentioned to get the answer?

Data collection

Based on the data needed in the study, the data collection technique used was direct interviews with students who met the criteria as subjects. The interview time was determined by adjusting the student's study schedule through information or teacher suggestions. Interviews were conducted to collect information about students' reflective thinking processes in solving non-routine mathematical problems. The interview technique in this study was an in-depth interview technique, namely an open, not strictly structured, not in a formal atmosphere and can be repeated on the same object. The interview in this study was semi-structured, namely an interview with an outline of questions that had been prepared by the researcher.

Data Validation

For test data credibility (trustworthiness) to the data), researchers do triangulation . In research this is the triangulation used is triangulation method. For method triangulation, the information obtained is rechecked for its degree of trustworthiness through different methods in a qualitative study. The data compared in this study are written test results with interview results. Data to be valid if the data obtained from the test method is the same as the data obtained from the interview method. Data from written test results that are different from data from interview results are then said to be invalid data and will be reduced in the study.

Analysis

Next Data obtained obtained from results Work student analyzed with use stages activity in analyzing qualitative data that is stage data reduction, stage data presentation and stages withdrawal conclusion. In the research This analysis in a way overall done with steps as the following : (1) Data Reduction, data reduction is form purposeful analysis for sharpening , selecting, focusing, abstracting, and transforming raw data obtained in the field into meaningful data. In research This is the raw data obtained from results study in the field reduced for get the real data needed in describe think reflexive student in solve problem mathematics reviewed from difference ability beginning. (2) Stage data presentation, data collection after reduced organized and categorized. At this stage this is more data simple served in form more narrative concise, so that allow for withdrawn conclusion from the data. (3) Drawing conclusions, drawing conclusions conclusion is activity summarize data and inspect the truth of the data that has been collected about How reflective thinking student in solve mathematics problem reviewed from difference ability beginning.

Results and Discussion

Thinking Process Reflective Students with Initial Abilities Higher Mathematics Subject ST 1

Thinking process reflective student with ability beginning mathematics high subject ST 1 in solve problem mathematics non-routine according to stage breakdown Polya's problem is shown the following.

Written Test Data

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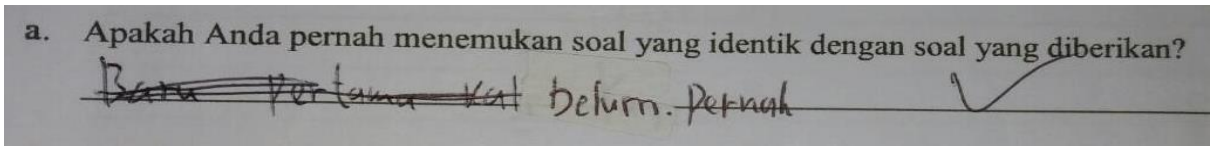

Figure 1. Answers to Written Test Part (a) Subject ST1

First, subject ST1 wrote on the answer sheet that the problem given was classified as something he had never encountered inside and outside of learning. This means that the problem given was a non-routine problem for subject ST1.

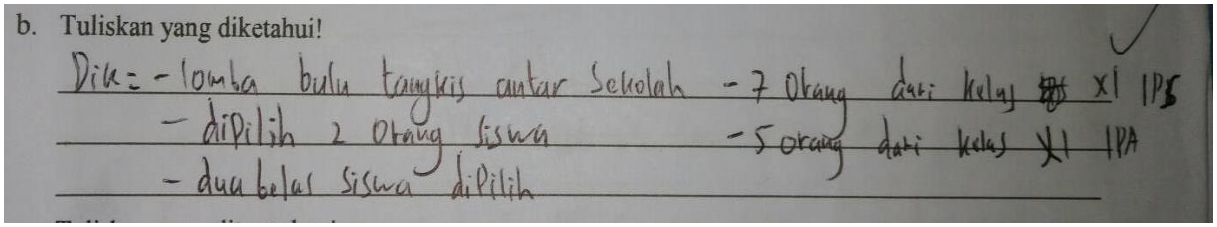

Figure 2. Answers to Written Test Part (b) Subject ST1

Second, subject ST1 demonstrated critical thinking at the *clarification stage* , namely being able to write down what is known about the given problem in detail, clearly, precisely and carefully. This means that subject ST1 is able to understand the problems given .

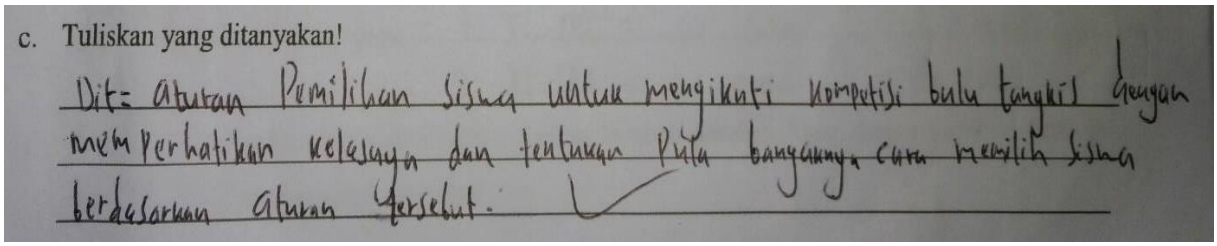

Figure 3. Answers to Written Test Part (c) Subject ST1

Third, subject ST1 showed critical thinking at the *assessment stage* , namely being able to write down what was asked in the given problem. The information provided was clear, precise, thorough and relevant to the problem. This means that subject ST1 understood the objectives to be achieved from the given problem.

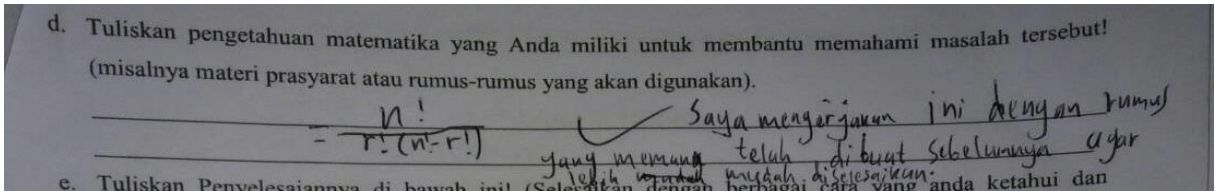

Figure 4. Answers to Written Test Part (d) Subject ST1

Fourth, subject ST1 showed creative thinking at the *elaboration stage* , namely being able to write down the mathematical knowledge he has correctly to help understand and solve the given problem. This means that subject ST1 is able to link the information known and asked with the knowledge he has based on his learning experience in order to find a solution to the given problem.

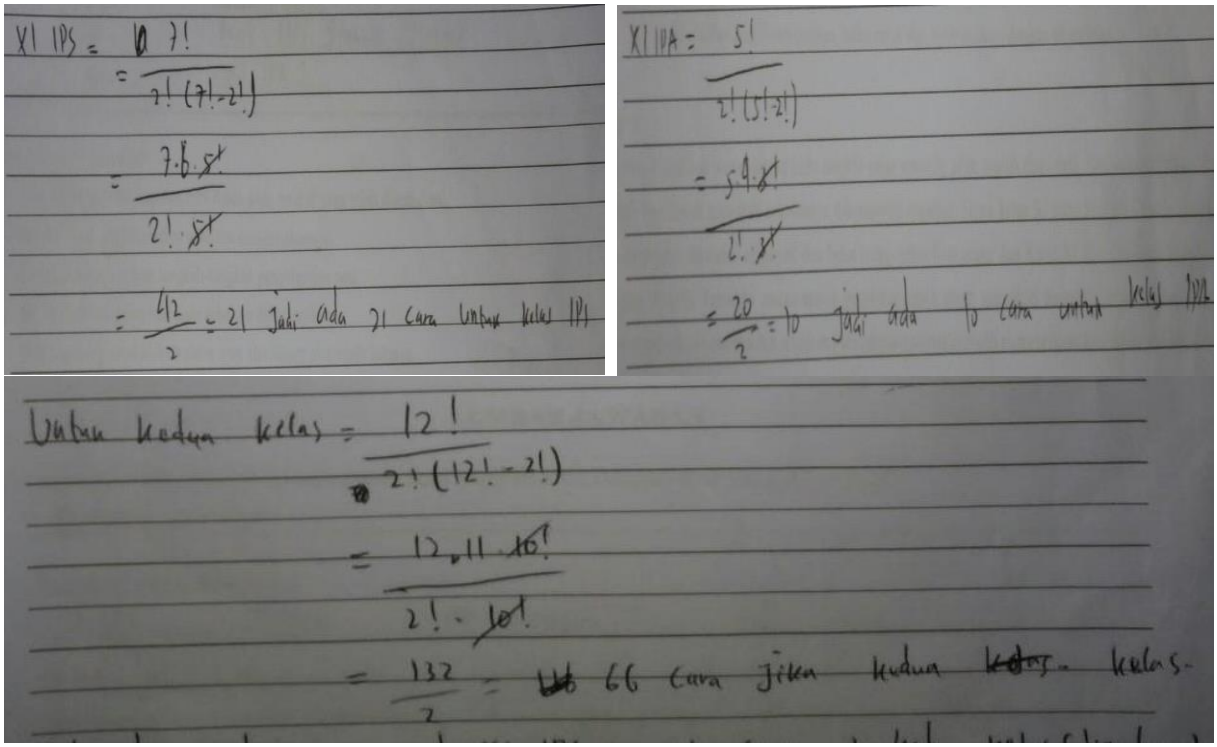

Figure 5. Answers to Written Test Part (e) Subject ST1

Fifth, subject ST1 showed critical thinking at the *inference stage* , namely being able to write down solutions to problems given with clear steps. The concept used to solve the problem is clear, precise and relevant as written in section (d) of the initial mathematical knowledge he has to solve the given problem. In addition, subject ST1 showed creative thinking at the *fluency* and *flexibility stages* because From the answer sheet of subject ST1, it can be seen that there are three different solutions proposed to solve the problem and the solutions given are precise, clear and logical. In addition, subject ST1 is already sure of his answer because there is a √ mark at the end (meaning he has checked his answer again). Based on the answer sheet, subject ST1 has been able to solve the given problem using the appropriate concept and each step is accompanied by clear and logical reasons.

Reflective Thinking Process of Students with High Initial Mathematical Ability Subject ST2

Thinking process reflective student with ability beginning mathematics high subject ST 2 in solve problem mathematics non - routine according to stage breakdown Polya's problem is shown the following .

Written Test Data

Written test answer sheet for subject ST2:

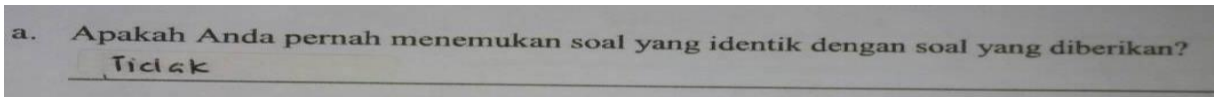

Figure 6. Answers to Written Test Part (a) Subject ST2

First, subject ST2 wrote on the answer sheet that the given problem was classified as one that he had never encountered inside and outside of learning. This means that the given problem was a non-routine problem for subject ST2.

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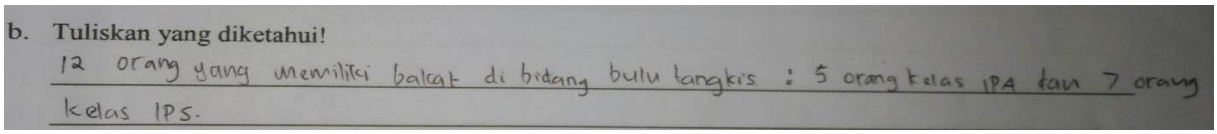

Figure 7. Answers to Written Test Part (b) Subject ST2

Second, subject ST2 showed critical thinking at the *clarification stage* , namely being able to write down things known about the given problem in detail, clearly, precisely and carefully. This means that subject ST2 is able to understand the given problem.

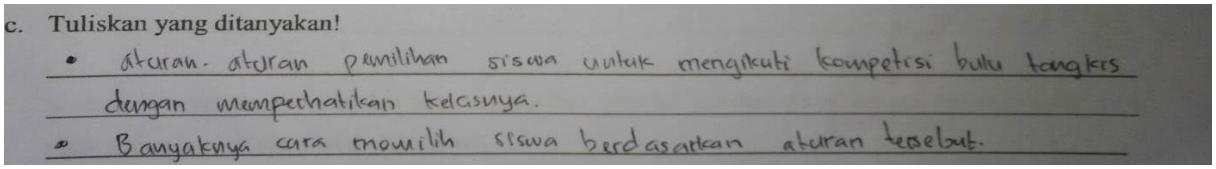

Figure 8. Answers to Written Test Part (c) Subject ST2

Third, subject ST2 showed critical thinking at the *assessment stage* , namely being able to write down what was asked in the given problem. The information provided was clear, precise, thorough and relevant to the problem. This means that subject ST2 understood the objectives to be achieved from the given problem.

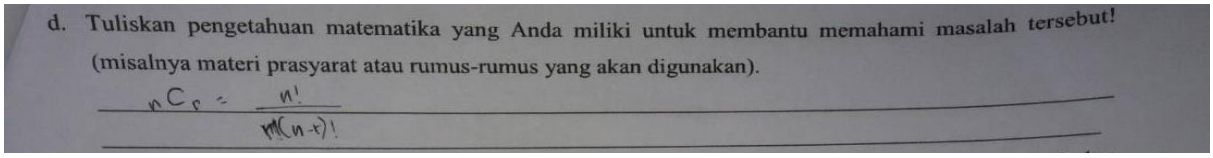

Figure 9. Answers to Written Test Part (d) Subject ST2

Fourth, subject ST2 showed creative thinking at the *elaboration stage* , he could write down the mathematical knowledge he had to help understand and solve the given problem, subject ST2 wrote down the formula of the combination. This means that subject ST2 was able to relate the information known and asked with the knowledge he had based on his learning experience in order to find a solution to the given problem.

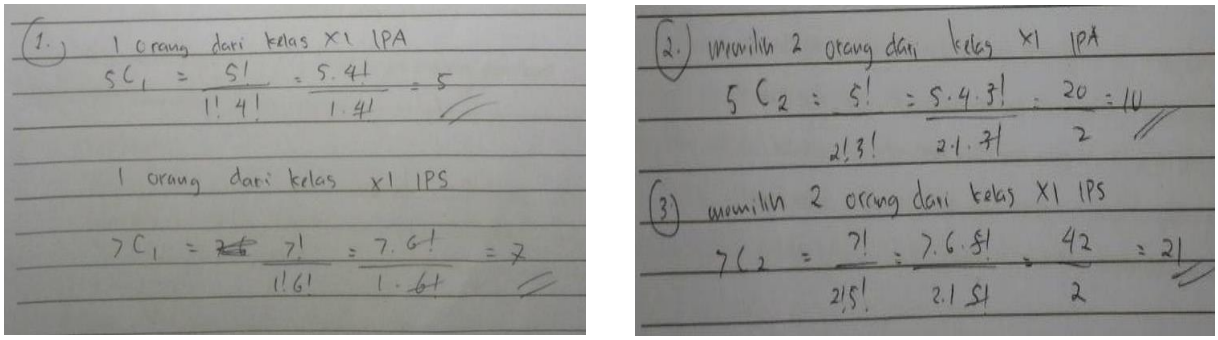

Figure 10. Answers to Written Test Part (e) Subject ST2

Fifth, subject ST2 showed critical thinking at the *inference stage* , namely being able to write down solutions to problems given with clear steps. The concept used to solve the problem is clear, precise and relevant as written in section (d) of the initial mathematical knowledge he has to solve the problem given. In addition, subject ST2 showed creative thinking at the *flexibility stage* because From the answer sheet of subject ST2, it can be seen that there are three

different solutions proposed to solve the problem. Two of the solutions given are correct, clear and logical, while one more solution still requires one more stage to reach a conclusion to solve the problem. In addition, based on the answer sheet, it is concluded that subject ST2 has not checked his answers again because there is no √ mark at the end of each solution given (as instructed on the answer sheet). Based on the answer sheet, subject ST2 has been able to solve the problems given using the appropriate concept and each step is accompanied by clear and logical reasons.

Reflective Thinking Process of Students with High Initial Mathematical Ability Subject ST3

Thinking process reflective student with ability beginning mathematics high subject ST 3 in solve problem mathematics non - routine according to stage breakdown Polya's problem is shown following .

Written Test Data

Written test answer sheet for subject ST3:

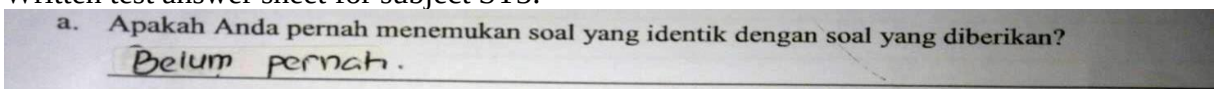

Figure 11. Answers to Written Test Part (a) Subject ST3

First, subject ST3 wrote on the answer sheet that the problem given was classified as something he had never encountered inside and outside of learning. This means that the problem given was a non-routine problem for subject ST3.

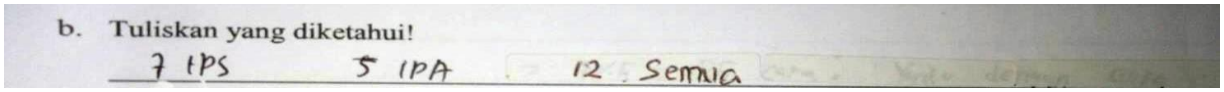

Figure 12. Answers to Written Test Part (b) Subject ST3

Second, subject ST3 showed critical thinking at the *clarification stage* , namely being able to write down what is known about the given problem. This means that subject ST3 is able to understand the given problem. Although, the information provided is not detailed and clear.

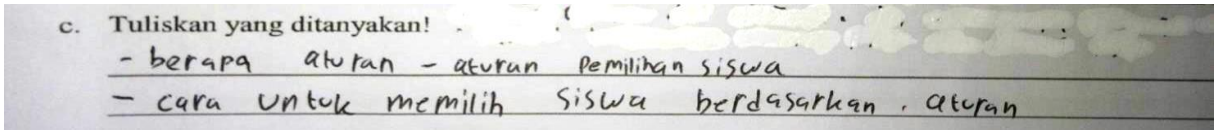

Figure 13. Answers to Written Test Part (c) Subject ST3

Third, subject ST3 showed critical thinking at the *assessment stage* , namely being able to write down what was asked in the given problem. The information provided was clear, precise, thorough and relevant to the problem. This means that subject ST3 understood the objectives to be achieved from the given problem.

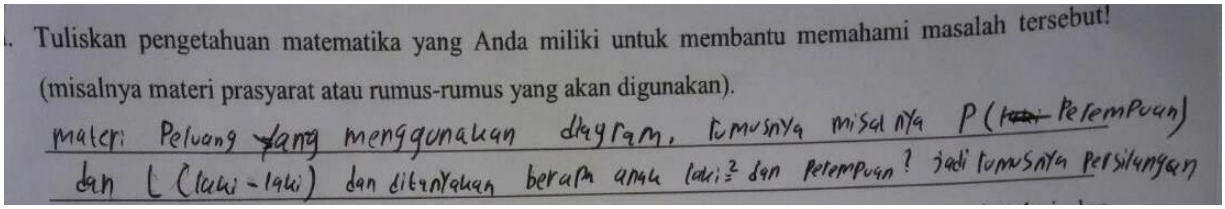

Figure 14. Answers to Written Test Part (d) Subject ST3

Fourth, subject ST3 did not show creative thinking at the *elaboration stage* because he could not write down the mathematical knowledge he had to help understand and solve the given problem. Subject ST3 wrote down the probability material that could be used to solve the problem. This means that subject ST3 was unable to link the information known and asked with

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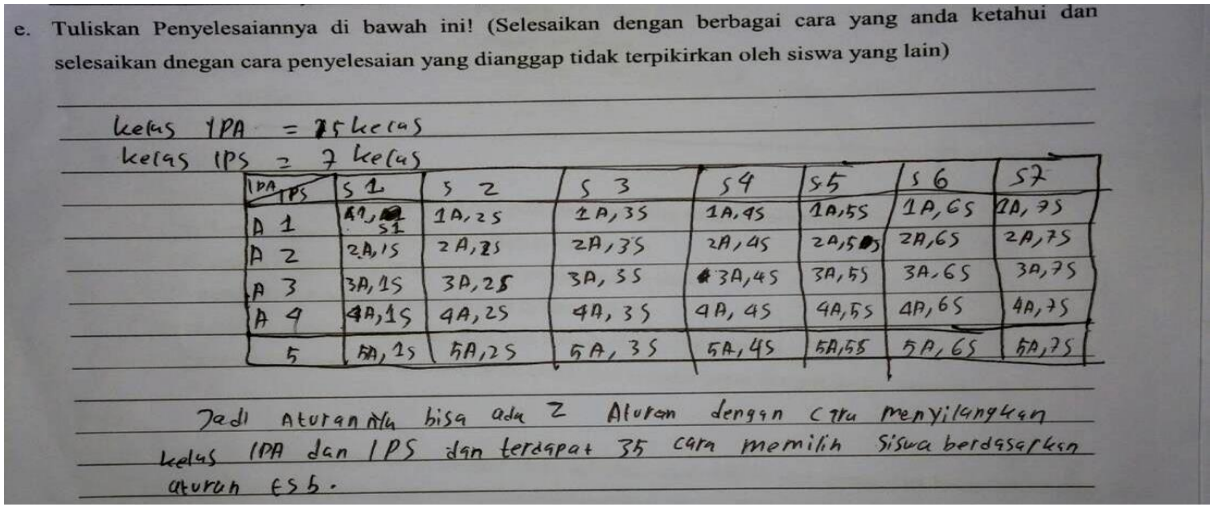
the knowledge he had based on his learning experience in order to find a solution to the given problem.


e. Tuliskan Penyelesaiannya di bawah ini! (Selesaikan dengan berbagai cara yang anda ketahui dan selesaikan dnegan cara penyelesaian yang dianggap tidak terpikirkan oleh siswa yang lain)

kelas IPA = 5 kelas
kelas IPS = 7 kelas

IPA / IPS	S 1	S 2	S 3	S 4	S 5	S 6	S 7
A 1	1A,1S	1A,2S	1A,3S	1A,4S	1A,5S	1A,6S	1A,7S
A 2	2A,1S	2A,2S	2A,3S	2A,4S	2A,5S	2A,6S	2A,7S
A 3	3A,1S	3A,2S	3A,3S	3A,4S	3A,5S	3A,6S	3A,7S
A 4	4A,1S	4A,2S	4A,3S	4A,4S	4A,5S	4A,6S	4A,7S
5	5A,1S	5A,2S	5A,3S	5A,4S	5A,5S	5A,6S	5A,7S

Jadi Aturan nya bisa ada 2 Aturan dengan Cara menyilangkan kelas IPA dan IPS dan terdapat 35 cara memilih Siswa berdasarkan aturan tsb.

Figure 15. Answers to Written Test Part (e) ST3 Subject

Fifth, subject ST3 showed critical thinking at the *inference stage* , namely being able to write down solutions to problems given with clear steps. The concept used to solve the problem is clear, precise and relevant, but does not match what was written in section (d) of the initial mathematical knowledge he has to solve the problem given. Subject ST3 did not show creative thinking at the *flexibility stage* because From the answer sheet, subject ST3 only proposed one alternative answer to solve the problem. However, subject ST3 showed creative thinking at the *originality stage* because it could provide a different, unique and unusual solution. Subject ST3 used the help of a table to solve the problem so that the selected student pairs were clearer. In addition, based on the answer sheet, it was concluded that subject ST3 had not checked his answers again because there was no √ mark at the end of each solution given (as instructed on the answer sheet). Based on the answer sheet, subject ST3 was able to solve the given problems using the appropriate concept and each step was accompanied by clear and logical reasons.

Discussion

Understanding the problem

Based on the interview results, it is known that when understanding the problem, in general the three subjects, namely subject ST1, subject ST2 and subject ST3, can retell the problem given in their own sentences accompanied by information that is known and asked. The subjects mentioned information on the number of students who are entitled to be selected to take part in the badminton selection, detailed the students who are entitled to be selected based on their class and mentioned the number of students who will be selected to take part in the competition. The subject stated that what was asked from this problem was how many rules for selecting two students if their original class was considered and from these rules how many ways there were to select the two students. Furthermore, the subject considered that the information in the problem was complete to find a solution to the problem. In line with the research (Wulansari et al., 2019) that at this stage understand problem Subject capable explain what is known already enough for answer what is asked . In other words, subject understand with clear what is desired from questions , information available and steps to be taken done for answer question . In addition, it is known that given problem nature non-routine for the subject

so that the subject does not immediately recognize or realize the meaning of the question so that a deeper understanding is needed.

Based on description the known that third the subject that capable beginning mathematics high show think creative at the stage *elaboration*, namely being able to retell the given problem using one's own language . This is in line with the opinion (Suwartia & Syaiful, 2023) that states that Subject mention all information with use your own words and explain it in a way sequentially. Delete the answer is considered wrong with method repair answer. Subject demonstrate critical thinking at *the clarification stage* namely capable identify known information from given problem, subject can understand the thought process alone in dig visible information moment answer question researcher. Subject show think critical at stage *assessment*, namely being able to state what is asked in the question and being able to identify that the required information is complete, the subject also explains reason from every step in his thought process so that there is careful consideration before believe what is understood.

Subject demonstrate creative thinking at the *elaboration* stage, namely being able to connect their initial knowledge with the given problem. Subjects ST1 and ST2 can connect information obtained with knowledge possessed for understand situation , but subject ST3 experienced mistake in connect information obtained and classify it moment interview (*elaboration*- creative thingking). This is in line with research which (Noviyanti et al., 2021)states that that at this stage understand problem in reacting phase, subject in test written and also interview capable do all things to do done by students in The reacting phase is : capable mention what is known in question , able mention what is being asked in question , able mention connection between those asked with what is known, and capable explain what is known already enough for answer the question. so too with research conducted by Wulansari et al., (2019) that subject capable connect between the questions asked with what is known . Thus, third subject indicates has do reflection to What is he did in understand problem .

Planning problem solving strategies

Based on results interview known that moment compile problem solving strategy problem, in general third subject demonstrates critical thinking at the *inference stage*, namely being able to represent problems with symbols and being able to compile and explain a well - laid plan for solve problem. Like opinion from Noviyanti et al., (2021) that at this stage compile plan in comparing phase, subject capable explain the strategy or steps that have ever been used for finish question as well as capable explain the strategies considered effective for finish question. Subjects ST1 and ST2 can connect known information with draft or experience that is owned, but subject ST3 experienced mistake in connect known information with the concept owned so in a way general subject Already connect known information with draft or experience possessed so that compilation plan accompanied by clear reasons. In line with study from Wulansari et al., (2019) that state that subject capable connect the problem asked with problems that ever faced . In addition, Adha & Rahaju (2020) state in analysis of student experience stage with intelligence logical-mathematical high formulate hypothesis beginning with mention difference between long experience with new experience. students formulate hypothesis the final with make plan settlement related issues with experience duration.

Moment breakdown problem subject demonstrate creative thinking at *the elaboration stage,* namely expressing relatedness between known information with the relevant knowledge he has to solve the problem. This is in line with research conducted (Suwartia & Syaiful, 2023) that state that student tend finish problem with use experience possessed before and not easy affected with context or given problem. Subjects ST1 and ST2 showed creative thinking at the *fluency stage*, namely being able to propose more than two alternative ways to solve the problem. The subjects stated that to determine the selection of two students to participate in the badminton competition by considering their original class, there are three rules, namely first:

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the two students are selected from class XI IPS, second: the two students are selected from class XI IPA and third: two students are selected from class XI IPS or XI IPA. While ST3 subject only propose One alternative solution breakdown Subject problem is able to demonstrate fluency in proposing problem solving strategies.

Based on description said , third subject with ability mathematics high demonstrate critical thinking at the *inference stage*, namely being able to represent problems in symbols and can develop strategies along with with reason which is clear. Third subject demonstrate creative thinking at the *elaboration stage,* namely do reflection to information that obtained Then connected to strategize. The three subjects showed creative thinking at the *fluency stage*, namely proposing three alternative solutions to the problem. In addition That with considerations that have been done, subject explain how is the plan the arranged with sure and visible moment answer question researcher. Therefore that, in a way general third subject indicates has do reflection to What is he did in devise a solution strategy problem .

Implementing problem solving strategies

Based on results breakdown issues and interviews presented previously, it was known that third subject in a way general capable demonstrate critical thinking at the *inference stage*, namely being able to implementing a problem-solving strategy problem in accordance with what has been planned by using a combination concept because the order of student selection is not considered. This is in accordance with research from Noviyanti et al., (2021) that at this stage carry out plan breakdown the problem that is done in subject contemplating phase capable finish problem in accordance with the strategy that has been determined. Subject has do careful consideration in compilation plan so that feel certain to carry out plan.

Subject show think creative at the stage *flexibility* , namely being able to provide various solutions, namely three alternatives, precisely according to what has been planned. Subjects ST1 and ST2 provide three alternative diverse solutions, although subject ST2 experienced mistake in finish One the alternatives it offers, whereas ST3 subject only give One alternative solution . The alternative answers given by subject ST1 are first: choosing two students from class XI IPS and the number of ways to choose students with the rule is obtained from a combination of 2 out of 7 students according to the plan, second: choosing two students from class XI IPA and the number of ways to choose students with the rule is obtained from a combination of 2 out of 5 students and third: choosing students from class XI IPA or XI IPS and the number of ways to choose students with the rule is obtained from a combination of 2 out of 12 students. Subject ST1 has not shown creative thinking at the *originality stage* because the alternative answers given are not unique, new or rarely thought of by other students of the same age. Subject ST1 uses the combination concept, namely a concept commonly used by students, because the combination concept is usually the way that is generally taught in the learning process. This is also shown from the research (Suwartia & Syaiful, 2023) that stylish student cognitive field independent use reflective thinking to get pattern from various solutions found and determined connection to make decision optimal answer. Subject demonstrate critical thinking at the *inference stage*, namely being able to explain breakdown problem in accordance with a well-planned strategy with fluent. Subject own clear reason so that implementation of the strategy can explained in accordance with what was planned. Subject believe the answer obtained is correct And complete. Subject do reflection to solution obtained so that feel confident with the answer.

Based on description said, in a manner general third subject with ability mathematics high demonstrate critical thinking at the *inference stage,* namely being able to implementing a problem solving strategy problem with implementing the strategies that have been planned

accompanied by clear beliefs and thoughts until obtained solution . The subject showed creative thinking at the *flexibility stage* , namely being able to provide three alternative answers to solve the problem. The subject has not shown creative thinking at the *originality stage* because the solution given is still generally used or thought of by other students. Subject demonstrate critical thinking at the *inference stage*, namely being able to explain breakdown problem in accordance with a well-planned strategy with fluent . Therefore that , subject indicates has do reflection at the stage of implementing problem solving strategies only on three of the four specified indicators.

Rechecking the troubleshooting

Based on results interview known that in a way general third subject have checked return steps settlement the problem and admitted to not finding any errors , the due to Because s subject has do careful consideration so that feel certain with the answer. In addition, the subject showed critical thinking at the *strategy stage*, namely convey alternative strategy or solution breakdown given problem accompanied by with reason clear. Subject demonstrate creative thinking at the *elaboration stage*, namely connect what has been done and what 's still can done so that obtained alternative solution or strategy of the given problem . This is in line with study Kholid et al., (2021) that subject connect concepts from information provided to find information new to obtain solution. Research from Noviyanti et al., (2021) which states that subject capable analyze connection or the relationship (similarities and differences) between problems that ever faced previously with the given problem. With the words other, subject do reflection to solution obtained so that capable identify things that are still Not yet appropriate or Not yet complete from the answer. This is in line with study (Febrianty et al., 2024) that subject Still experience a number of difficulty on indicators inspect back, thing this due to learning not yet process-oriented thinking reflective supporting mathematics ability breakdown problem mathematical and not yet used to face non - routine problems. The subject did not write down all the alternative answers to solve the problem, but the subject realized that there were still alternative answers that had not been thought of when working on the problem, namely choosing one student from class XI IPA and one student from class XI IPS. Subject also feel Certain to the answer through checking computing .

Based on description said, the subject inspect return breakdown the problem that is done and believe that the solution he obtained is correct. The subject shows critical thinking at the *strategy stage*, namely conveying alternative strategy or solution breakdown given problem accompanied by with reason which is clear and distinguishes valid and invalid conclusions regarding the given problem solution. The subject shows creative thinking at the *elaboration stage* , namely realizing that there are still alternative answers other than the ones he wrote. Therefore, reflective thinking student can understand, criticize, assess, search solution alternatives, and evaluate issues or ongoing problem faced or temporary studied. To ensure steps and answers already correct. In addition, the subject feels confident with his answer because he rechecked the alternative answers he gave in solving the problem. Subject ST has show the process reflective thinking moment step inspect return .

Conclusion

Based on the results of the research and discussion, the following conclusions were obtained students class XI IPA 1 SMAN 10 Makassar with ability beginning mathematics high in a way general show the thinking process reflective on four step breakdown problem according to polya in problem mathematics non-routine . Steps to understand problem : (a) third subject can state return problem with sentence alone or through representation symbols with careful and detailed (*elaboration*-thinking) creative); (b) in a general third subject can identify the facts given with clear and logical (*clarification*-critical thingking); (c) third subject can find

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important question in question based on information needed (*assessment*-critical thingking); and (d) third subject can determine information that is needed and that is still Not yet fulfilled accompanied by logical and clear reasons (*assessment*- critical thingking), and (e) first and second subjects can connect information obtained with knowledge possessed to understand situation , but third subject experienced mistake in connect information obtained and classify it moment interview (*elaboration* – creative thingking).

Steps to planning a strategy: (a) third subject can represent problem in symbols (inference-critical thingking); (b) third subject can devise a solution strategy problem accompanied by with logical and clear reasoning (*inference*-critical thingking); (c) first and second subjects can connect known information with draft or experience that is owned , but third subject experienced mistake in connect known information with the concept owned (*elaboration*-creative thingking); and (d) first and second subjects are able propose three alternative solution to breakdown problem with right, whereas third subject only propose one alternative solution breakdown problem (*fluency*– creative thingking).

Steps to implement the strategy: (a) third subject can implementing a problem-solving strategy problem accompanied by logical and clear reasons (*Inference*-critical thingking); (b) first and second subjects gave three alternative diverse solutions, although second subject experienced mistake in finish one the alternatives it offers , whereas third subject only give one alternative solution. (*flexibility*-creative thinking); (c) third subjects can give different solutions or rare/uncommon solution thought of by other students, while first and second subjects have not show different solutions still use the common way used namely combination (*originality* – creative thinking); and (d) third subject can to communicate implementation of problem solving strategy problem with representation symbols (*inference* – critical thinking).

Steps checking back the answer (a) third subject can connect what has been done and what remains to be done can done to develop breakdown the problem that has been done , even though third subject new realize that still there is other alternatives at the moment interview after through a number of leading questions from researcher (*elaboration* – creative thinking); (b) third subject can differentiate between conclusions based on valid/ invalid logic (*strategies* – critical thinking); and (c) third subject can convey alternative strategy or solution from breakdown problem with accompanied by logical and clear reasons (*strategies* – critical thinking). From the results research , we highlight impact from students who have hight ability. However experience problem in the process of thinking reflective on solving non-routine problems given , cause based on findings in research This there is a number of weakness student in finish problem mathematics even though classified as own ability mathematics high . As the alternative educator can make variation in the learning process, for example with learning cooperative to happen interaction between participant educate impulsive-reflective and fast accurate-slow inaccurate. In addition , the study in study This Still limited to thinking reflective student in solve non-routine material problems opportunity reviewed from ability mathematics high. Other researcher can also reviewed from ability mathematics medium and low , the difference style cognitive or style Study other to expand coverage the material.

Conflict of Interest

The author declares no conflict of interest.

Authors Contribution

A. conceived the research idea presented and collected the data. The other author (B.) actively participated in the development of theory, methodology, organization and analysis of data, discussion of results and approval of the final version of the work. All authors state that the final version of this paper has been read and approved. The total percentage of contribution to the conceptualization, preparation and correction of this paper is as follows: A.: 60%, and B.: 40%.

Data Availability Statement

The author declares that data supporting the results of this study will be made available by the corresponding author, [A.], upon reasonable request.

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