



## Truth-Seekers Students' Critical Thinking Process in Solving Mathematics Problems with Contradiction Information

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### Abstract

The aims of this study are (1) to describe the critical thinking processes of truth-seekers students in solving math problems with contradiction information based on the theory of mental mechanisms and structures, and (2) to find valid and effective learning models to improve the critical thinking processes of truth-seekers students. The subjects of this study were truth-seekers at SMPN 7 Jember. Data collection methods in this study were tests, observations, and interviews. The results of the research are that students who do truth-seeking in this study build mental mechanisms consisting of interiorization, coordination, and encapsulation and construct all mental structures, namely actions, processes, objects, and schemas. So, it can be concluded that the mental mechanism process of truth-seekers students in this study is not complete even though the mental structures have all been constructed in their minds. The model found to improve the critical thinking process based on the research findings is the infusion learning model by focusing on the habit of solving mathematical problems with contradiction information.

### Abstrak

Tujuan penelitian ini adalah (1) mendeskripsikan proses berpikir kritis siswa truth-seekers dalam menyelesaikan soal matematika dengan informasi yang kontradiksi berdasarkan teori mekanisme dan struktur mental, dan (2) menemukan model pembelajaran yang valid dan efektif untuk meningkatkan proses berpikir kritis siswa yang truth-seekers. Subjek penelitian ini adalah siswa yang truth-seekers di SMPN 7 Jember. Metode pengumpulan data pada penelitian ini adalah tes, observasi, dan wawancara. Hasil dari penelitian yaitu siswa yang melakukan truth-seeking dalam penelitian ini membangun mekanisme mental yang terdiri dari interiorisasi, koordinasi, dan enkapsulasi serta mengkonstruksi seluruh struktur mental yaitu aksi, proses, objek, dan skema. Sehingga dapat disimpulkan bahwa proses mekanisme mental siswa truth-seekers dalam penelitian ini tidak lengkap walaupun struktur mentalnya telah dikonstruksi semua dalam pikirannya. Model yang ditemukan untuk meningkatkan proses berpikir kritis berdasarkan temuan penelitian adalah model pembelajaran infusi dengan memfokuskan pada pembiasaan pemecahan masalah matematika dengan informasi yang kontradiksi.

**Keywords:** Critical Thinking; Truth-Seeking; Problem with Contradiction Information, Mechanism and Mental Structure.

## INTRODUCTION

One of the important thinking skills that everyone should have is critical thinking. By thinking critically, one's ability to reason and deal with problems will increase, one of which is in the field of education or learning. According to Noruzi (2010) critical thinking skills help a person understand and accept the opinions of others well. Critical thinking also trains a person to think logically. An institution called Partnership for 21st Century Learning (2015) conducted a study, finding that one of the basic skills that students must possess is the ability to think critically. This is also in accordance with the framework of learning competencies in the 21st century or commonly known as the 4C's, namely (1) critical thinking skills, (2) creative thinking (creativity), (3) communication (communication), and (4) collaboration (Partnership for 21st Century Learning, 2015). Therefore, it is important for someone, especially students, to think critically.

Critical thinking is referred to as reflective thinking and is also logical to make reasonable decisions about what to believe or do (Ennis, 1989). Critical thinking can also be defined as activities related to analyzing and evaluating arguments (Paul, R., & Elder, 2006). In addition, Maričić, S., & Špijunović (2015) expressed the opinion that critical thinking can also be interpreted as an intellectual activity that focuses on one's skills in formulating a matter, analyzing problems, and evaluating them. Therefore, from the expert definition above, it can be concluded that critical thinking is reflective and logical thinking that can help students in many ways such as analyzing, evaluating, and making decisions about what to believe and will do. Critical thinking has two components, namely ability and disposition (Ennis, 1989; Facione, 2000; Facione et al., 1995). Critical thinking ability cannot be seen

directly and is defined as a person's intellectual activity in applying cognitive abilities of interpretation, analysis, inference, evaluation, explanation and self-monitoring metacognition in deciding what to believe (Akinoğlu & Karsantik, 2016). The disposition of critical thinking can be seen from how a person behaves or behaves. Facione (2000) defines critical thinking disposition as self-motivation consistently to act critically in dealing with a situation or problem. According to As'ari et al. (2017) someone who has a critical thinking disposition is a person who bases critical thinking before carrying out an action and making decisions.

The disposition of critical thinking is very important for students in solving a problem. Attitudes or dispositions determine the outcome of solving existing problems. When a person's critical thinking disposition increases, problem solving abilities will also increase (Kanbay & Okanlı, 2017). When students have the disposition to think critically, they will first check the truth of the questions and classify the things in the questions before solving them. On the other hand, if students do not have the disposition to think critically, they will immediately work on the questions without first paying attention to the truth of the information contained in the questions (Kurniati et al., 2020).

According to CCTDI (California Critical Thinking Disposition Inventory), there are 7 characteristics or components that can indicate someone has a critical thinking disposition, namely (1) truth-seeking (2) open-mindedness, (3) curious attitude (inquisitiveness), (4) analyticality, (5) systematicity (6) self-confidence, and (7) maturity. One component that is the main characteristic of people with critical thinking dispositions is truth-seeking. Someone with a disposition to think critically has a tendency to engage in truth-seeking activities (Cheng, M. H. M., & Wan, 2017;

Facione, 2000). This is because truth-seeking is closely related to solving a problem. When faced with a problem, people with a disposition to think critically tend to think openly, carefully, systematically, and carry out truth-seeking activities (Cohen, 2010).

Insight Assessment (2017) defines truth-seeking as a habit of always wanting the best understanding of a particular situation. A person who is able or has the ability to truth-seeking is characterized by the characteristics of (1) trying to make the best understanding of certain situations, (2) emphasizing on evidence and reasons that have been acknowledged to be true, (3) questioning his beliefs to people who understand something better, and (4) pay attention to important things in detail. Based on research conducted by Tümkaya et al. (2009) related to the disposition of critical thinking to 343 students consisting of freshmen and seniors at one of the largest public universities in Turkey, the average critical thinking disposition score for new and senior students with male gender was 189.15 and 209.41, while for the female sex, they were 189.7 and 209.34, respectively. CCTDI (California Critical Thinking Disposition Inventory) reveals that if the score is below 280, it means that a person is not in a critical thinking disposition. In addition, from the results of research conducted by Kurniati et al. (2019) related to student truth-seeking, it was found that students tend to assume that the questions given by the teacher or lecturer are always correct. This indicates that the number of students who have a critical thinking disposition is low so that students who have truth-seeking abilities are also low. Therefore, if there are truth-seekers students, it can be said that these students are unique, so it is necessary to conduct research that focuses on how the thinking processes of truth-seekers students solve problems.

One way to find out students' critical thinking dispositions is to give them or confront them with mathematical problems. However, not all mathematical problems can be used to find out which students have the disposition to think critically. Students must be given a problem that encourages students to solve it immediately but is also required to analyze it first. There are 8 kinds of questions that can be used to observe students having a critical thinking disposition. One of them is Problems With Contradictory Information (As'ari, Kurniati, Maharani, et al., 2019; Kurniati, Purwanto, As'ari, Dwiyan, et al., 2019). The indicators of students belonging to truth-seekers in this study refer to the indicators or characteristics proposed by the Insight Assessment in Table 1.

Table 1. Truth-Seeking Indicators

<i>Truth-Seeking Indicators</i>	<b>Truth-Seeking Indicators in Solving Problems with Contradictory Information</b>
Trying to do the best understanding	Gather all the information in the questions
Questioning his beliefs to people who understand more about a thing	Questioning all the information in the question Check the correctness of the information contained in the question
Emphasis on evidence and reason that have been acknowledged to be true	Write contradictory information in the problem State or write down evidence and logical reasons to support the statement
Pay attention to important things in detail	Do not write down answers, but with notes, students understand if there is contradictory information in the questions Write down the answer that the problem has no solution Find a solution based on the correct information

Truth-seeking is closely related to one's knowledge. Knowledge according to Piaget's view is a cognitive construction of one's activities. Piaget (in Suparno, 1997) views that knowledge needs to be formed

and built by someone who wants to know and needs to understand it. So that the disposition of critical thinking and truth-seeking is also very dependent on an individual constructing his knowledge. In this regard, APOS Theory is a theory of mathematics learning that aims to understand the mental mechanism or reflective abstraction proposed by Piaget. Mental structure construction or APOS consists of 4 stages, namely action (action), process (process), object (object), and schema (schema) which were previously preceded by mental mechanisms. There are five types of mental mechanisms, namely internalization, coordination, reservation, encapsulation, and generalization (Dubinsky, 2000). APOS theory says that an individual must have an adequate mental structure to understand concepts and solve mathematical problems.

There has been research that focuses on the mechanisms and mental structures of students who carry out truth-seeking activities in solving math problems. Based on research by Kurniati *et al.* (2018) there are two mental mechanisms that are carried out by students, namely (1) students experience the process of interiorization and coordination, and (2) experience the process of interiorization, coordination, and reservation. Meanwhile, all the mental structures have been constructed by students. However, there is still no similar research on truth-seekers students. This is important considering the level of education also affects a person's critical thinking disposition (Tümkaya *et al.*, 2009). In detail, the mechanism and mental structure of a person in constructing his knowledge is depicted in Figure 1.

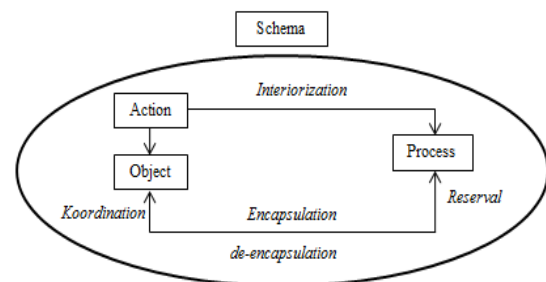


Figure 1. Mechanism dan Mental Structure

Based on what has been explained above, it is necessary to conduct research to find out and describe how the critical thinking process of truth-seekers students in solving problems with contradiction information based on the theory of mechanisms and mental structures. The next stage after knowing the tendency of the critical thinking process of truth-seekers students is to find a valid and effective learning model in increasing the tendency of the students' critical thinking process.

## METHODS

The type of research used in this research is descriptive research with a qualitative approach, followed by development research. This type of descriptive research is a type of research that uses descriptive descriptions with the aim of describing objects or phenomena clearly and in detail. This research is a qualitative descriptive study because it aims to describe the critical thinking process of truth-seekers students in solving math problems with contradictory information based on the theory of mechanisms and mental structures using words. The development research in this study is the development of a learning model that is adapted to the results of the study by meeting the valid and effective criteria.

The stages in this research are (1) making instruments consisting of test questions, observation sheets and interview guidelines, (2) giving test questions as well as observing students' truth-

seeking behavior when working on questions, (3) determining research subjects, (4) data analysis of test results and observations to determine critical thinking processes based on mental mechanisms and structures, (5) interviews with research subjects as a triangulation stage, (6) conclusions related to the thinking processes of truth-seekers, and (7) finding valid learning models and effective in improving students' critical thinking processes based on the results of preliminary research in stage (6). The valid criteria referred to in this study are based on the results of the validity test by 3 (three) mathematics education experts. Furthermore, the effective criterion in question is an increase in the critical thinking process of truth-seekers based on all mechanisms and mental structures after the application of the learning model found.

The subjects of this study were class VIII students at Junior High School 7 Jember who met the truth-seeking indicators when working on test questions with contradiction information. Data collection methods consist of test questions, observations, and interviews. The questions given are in the form of 1 item Problem with Contradiction Information. The question time is 20 minutes. When working on questions, students are asked to record the whole process / think-aloud. It aims to review what students did or said during the test. In addition, this study also conducted documentation in the form of video recordings of observations, recorded interviews, and photos of student work.



Figure 2. Test Work by Students (1)



Figure 3. Test Work by Students (2)

The test questions given are as follows.

Perhatikan barisan bilangan Fibonacci berikut!  
 1, 3, 4, 7, 11, ..., ..., 49, a, 125, ...  
 Tentukan nilai a dari barisan diatas!

#### Translate Version

Consider the following Fibonacci number sequence!  
 1, 3, 4, 7, 11, ..., ..., 49, a, 125, ...  
 Determine the value of a from the above sequence!

From this problem, it is known that the above sequence is a Fibonacci sequence, which is a sequence of numbers whose terms are the sum of the previous 2 terms. The 8th term of the sequence is 49. In fact, the 8th term should be 47 because it is the sum of the 6th and 7th terms, which are 18 and 29 respectively. The problem contains contradiction information so that the problem has no solution. Students who carry out truth-seeking activities before working on the questions will first check the truth of the questions. The action indicator on the question is that students read slowly and check the truth of the information in the question first. The indicator of the process is that students question the value and realize that the 8th term of the Fibonacci sequence in the problem is wrong. Then the object indicator, namely students show and prove that there is contradiction information. The last indicator is the schema, where students conclude that the question does indeed contain

contradiction information. From the results of student work and observations, interviews were conducted on research subjects. Interviews were conducted in a semi-structured manner, namely by providing questions that had been prepared previously in the interview guide, but researchers were also able to develop questions flexibly according to the topic and research objectives. Interviews were conducted to confirm and further explore the critical thinking processes of truth-seekers students in solving problems with contradiction information based on the theory of mechanisms and mental structures. The complete mechanism and mental structure of truth-seekers students in solving problems with contradiction information in this study can be seen in Figure 4.

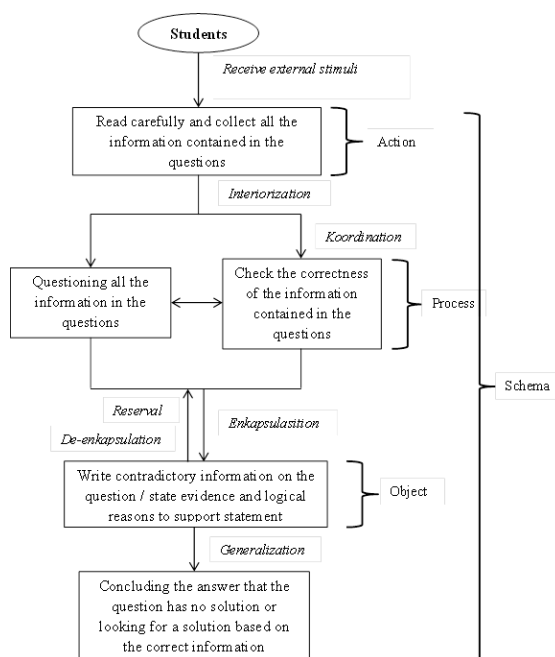


Figure 4. Mechanism and Structure Mental of Truth-Seeker Students

The last stage is finding a valid and effective learning model in improving students' critical thinking processes. The development of the learning model that will be found is based on the results of research on the tendency of students' critical thinking processes who are truth-seekers based on the theory of mechanisms and mental

structures. During the trial of the learning model that was found, the researcher focused on the habituation of truth-seekers in improving their critical thinking processes based on the theory of mechanisms and mental structures for 2 (two) lessons. The learning model found must at least meet the valid and effective criteria.

## RESULTS AND DISCUSSIONS

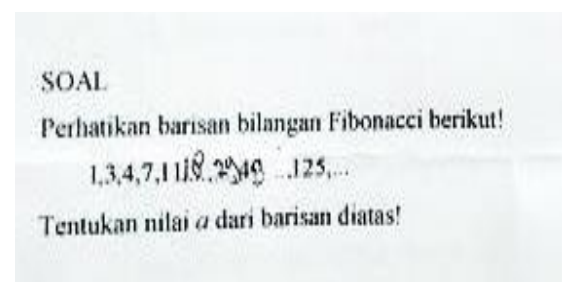
### Results

Based on the results of data collection obtained 1 student as a research subject. One student was chosen because based on test results and observations he fulfilled all truth-seeking indicators, (1) collected all the information in the questions, (2) questioned all the information in the questions, (3) stated logical evidence, and (4) seek solutions based on correct information.

### Discussion

#### *Analysis of Students Answer in Solving Problem with Contradiction Information*

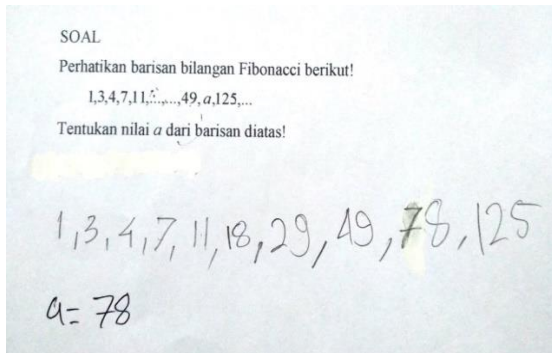
From the questions given above, 23 out of 24 students did not meet the criteria as research subjects. There were students who did not answer the questions and there were students who did not check the correctness of the information in the questions beforehand. The examples of answers from the 23 students are presented in Figure 5. and Figure 6.



## Translate Version

Consider the following Fibonacci number sequence!  
 1, 3, 4, 7, 11, **18**, **29**, 49, *a*, 125, ...  
 Determine the value of *a* from the above sequence!

Figure 5. One of Students Answer



## Translate Version

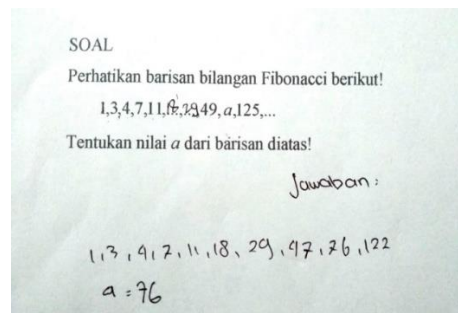
Consider the following Fibonacci number sequence!  
 1, 3, 4, 7, 11, ..., ..., 49, *a*, 125, ...  
 Determine the value of *a* from the above sequence!

**1, 3, 4, 7, 11, 18, 29, 49, 78, 125**  
**a = 78**

Figure 6. One of Students Answer (2)

It can be seen from Figure 5. Above students cannot find a solution to the problem. Students only write down their identities without any solution to the problem. While in Figure 6. students write the solutions to the problems given. However, in answering these questions students did not check the truth of the information contained in the questions first. The student answered a value of the Fibonacci sequence was 78. Even though the correct answer or solution was 76. The student did not check the correctness of the 8th term value first, but immediately added up the 6th and 7th term values. So, it can be said that 23 students still have not behaved truth-seeking.

While the truth-seeking process of the research subject when completing the test questions is as follows. Before deciding to write an answer, the student checks the correctness of the information contained in the question. The process of checking the truth of the information is done by looking for the value of the 6th and 7th terms first. From the search process, students begin to realize that there are contradictions in the questions. Students try to add up the values of the 6th and 7th terms, but the results do not match the information given in the questions. The next truth-seeking process is for students to write down evidence or logical reasons that the question contains incorrect information. Students seem to write down the correct sequence or information that should be on the question. The last process is that students write solutions based on the correct information. The final settlement was obtained by students, the value of *a* was 76. The answer from one student who behaved in truth-seeking is presented in Figure 7.



## Translate Version

Consider the following Fibonacci number sequence!  
 1, 3, 4, 7, 11, ..., ..., 49, *a*, 125, ...  
 Determine the value of *a* from the above sequence!

**Answer :**  
**1, 3, 4, 7, 11, 18, 29, 47, 76, 122**  
**a = 76**

Figure 7. Answer of Truth-Seekers Student

### ***Analysis of Think-Aloud and Interview Students in Solving Problem with Contradiction Information***

From the results of working on test and observation questions, interviews were then conducted on research subjects, namely students who behaved in truth-seeking to be confirmed and dug deeper regarding their thought processes in solving questions with contradiction information based on the theory of mechanisms and mental structures. Based on the results of the analysis of think-aloud recordings and interviews, it was found that the mechanism and mental structure of students were as follows. The students' thinking process begins by reading slowly and repeatedly the information contained in the questions first, namely *'Consider the following Fibonacci number sequence! 1, 3, 4, 7, 11, ..., 49, a, 125, ... Determine the value of a from the above sequence!'*. The next process is that students begin to question the value of the 8th term. Students realize that the 8th term of the Fibonacci sequence in the problem is not true. Students ask, *'18 plus 29 instead of 47'* This indicates that students construct actions and processes in their minds. The process of mentally applying the action in his mind is called interiorization. After that, students show evidence that it is true that there is contradiction information. The student says, *'The sum of the 8th terms should not be 49 because the 6th and 7th terms are 18 and 29 respectively'*. This states that students carry out the coordination process between mathematical objects in the problem and carry out encapsulation mechanisms because they can accept the previous process as an object. The last process that students do is solve problems based on correct information. Students write a value of the Fibonacci sequence on the problem is 76. In this case, it means that students construct

a schema because it can connect all mental structures of actions, processes, and objects. However, when asked during interviews, students still did not know if there were questions with contradiction information, students did not need to work on the questions because they did not have a solution.

In this case, the generalization mental mechanism has not been built. Students are still not able to apply the scheme to a wider range. This is in accordance with the research findings of Kurniati et al. (2018) which states that students always assume that the questions given by the teacher are always correct and have answers. Subjective norms experienced by students have not been able to fully demand students to respond critically (Kurniati et al., 2019). So that students have not been able to develop their critical thinking processes in responding to various types of questions given by the teacher. Based on think-aloud analysis and interviews, the research subjects, who in this case are truth-seekers, develop mental mechanisms consisting of interiorization, coordination, and encapsulation and construct the entire mental structure, namely actions, processes, objects, and schemas. In detail, the mechanism and mental structure of the subject in this study are described in Figure 8 below.

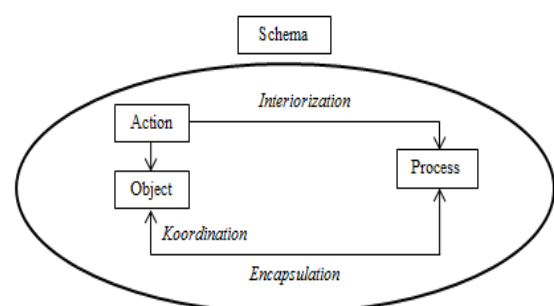


Figure 8. Mechanism and Mental Structure Truth-Seekers Students



### ***Infusion Learning Model Design to Familiarize Students with Truth-Seeking Behavior Based on Mechanism and Mental Structure Theory***

From the results of observations of truth-seeking behavior and students' thinking processes that were carried out previously, data was obtained that only 1 of 34 students behaved in truth-seeking. This indicates that the truth-seeking behavior by students is still low. This is also the same as a similar study by Kurniati et al. (2018), where there are only 4 students from the research population who behave in truth-seeking. Based on this, it is necessary to design learning that can familiarize students with truth-seeking behavior and construct their thinking based on the theory of mechanisms and mental structures. The learning design is learning with an infusion approach. According to Ennis (1989), there are 4 (four) kinds of approaches that can familiarize someone with a critical disposition. The four approaches are general approach, infusion approach, immersion approach, and combined approach. The infusion approach is a learning approach that uses certain material content in its learning. Apart from utilizing certain material content, infusion learning was chosen because it is used to get used to the disposition to think critically, especially truth-seeking (As'ari, et al., 2019; Ennis, 1989). During the application of the infusion learning model, students are still guided, and the changes can be clearly seen (As'ari, et al., 2019; Ennis, 1989). The learning design developed focuses on providing questions that can familiarize students with truth-seeking behavior, namely Problem with Contradiction Information. Infusion learning is applied for 2 meetings, where each meeting the teacher familiarizes students with solving problems that require students to have the disposition to think critically. The

problem giving was carried out for 2 meetings with each giving 2 questions with contradiction information.

The questions are as follows.

1. It is known that an arithmetic sequence with the first term is an odd number, and the difference is 3. If the value of  $U_{11} = 36$ , determine the value of 12th term of the number sequence!
2. Pay attention to the addition pattern for the following numbers.  

$$1$$

$$1 + 3$$

$$1 + 3 + 5$$

$$1 + 3 + 5 + 7$$

$$\vdots$$

$$1 + 3 + 5 + 7 + \dots + n, \text{ for } n \text{ positive integers}$$
 If the sum of the numbers in the nth row of the sequence pattern above is 125, so what value of n?
3. It is known that  $S = \{\text{even number}\}$ . If there is a sequence of numbers where the terms are members of the set S and if a, b, c are one of terms so that  $a+b+c=17$ , so investigate and determine the value of a, b, and c!
4. There is a sequence of Fibonacci numbers 1, 4, 5, ..., ..., 33, 47, X, ...  
Find the x value of the Fibonacci sequence!

The stages of truth-seeking infusion learning designed to familiarize or improve critical thinking processes based on mental mechanisms and structures are (1) delivery of learning objectives, (2) giving math questions with contradiction information, (3) joint discussion with students regarding checking the truth of all information on questions, (4) formation of groups consisting of 2 people, (5) completion of 2 (two) math problems with contradiction information, (6) joint discussion regarding problem solving that focuses on the existence of conflicting information or contradictions with mathematical facts that correct. The application of infusion learning was carried out for 2 meetings each (2x40) minutes.

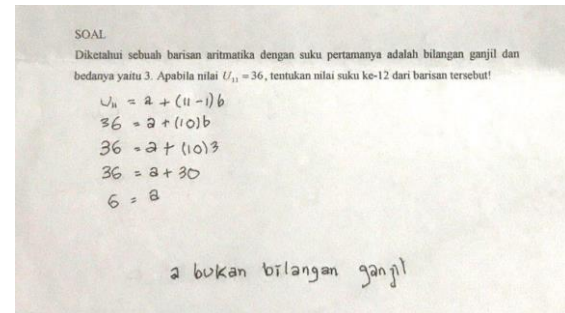
The design of the infusion learning model and the questions designed have been previously validated by 3 experts in mathematics education who are competent in the fields of mathematics and education. The results of the validation of the infusion learning design and the questions developed met the valid criteria with a score of 2.77. The validation aspects of the infusion learning design and math problems with contradiction information include content validation, construction validation, and language validation. The criteria for the level of validity used in this study are as shown in Table 2.

$V_a$ Value	Validity Level
$V_a = 3$	Strongly Valid
$2,5 \leq V_a < 3$	Valid
$2 \leq V_a < 2,5$	Quite Valid
$1,5 \leq V_a < 2$	Less Valid
$1 \leq V_a < 1,5$	Not Valid

After the validation test was carried out, the infusion learning design that met the valid criteria was applied to mathematics learning in class VIII of Junior High School 7 Jember with a total of 34 students. At each learning meeting the application of the infusion learning model design, the teacher focused on students' habits to always check all the correctness of the information provided. is in the question. This habituation is carried out at the beginning of learning before students work on questions with contradiction information.

From the results of the application of the infusion learning model, it was found that students tended to behave in truth-seeking and thinking process based on the theory of mechanisms and mental structures increased. A total of 6 groups or 12 students experienced changes to truth-seeking behavior from those who previously did not behave truth-seeking. Before working on the questions given, students

tend to first check the truth of the information contained in the questions. The examples of student answers in working on test questions during the application of the infusion learning model are as follows in Figures 9 and 10.



Translate Version

It is known that an arithmetic sequence where the first term is odd number and the difference is 3. If the value of  $U_{11} = 36$ , determine the value of the 12th term of the sequence!

**Answer :**

$$U_{11} = a + (11 - 1)b$$

$$36 = a + (10)b$$

$$36 = a + (10)3$$

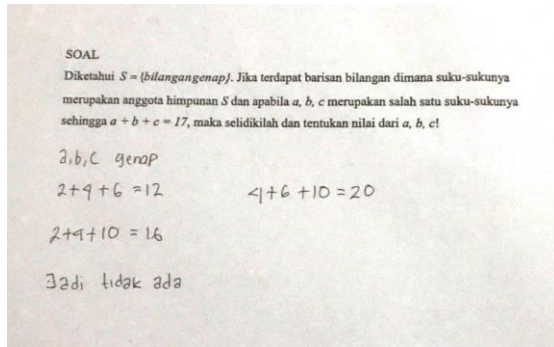
$$36 = a + 30$$

$$6 = a$$

**a is not an odd number**

Figure 9. Student Answer during Infusing Model Learning (1)

In Figure 9, before deciding to find the value of  $U_{12}$ , Students check the correctness of the information contained in the questions first. The process of checking the truth of the information is done by looking for the value of a first. After the search process, obtained a value of 6. From this, students realized that there was contradiction information in the question. Students write that the value of a should be an even number, not an odd number.



### Translate Version

It is known that  $S = \{\text{even numbers}\}$ . If there is a sequence of numbers where the terms are members of the set  $S$  and if  $a, b, c$  are one of the terms so that  $a + b + c = 17$ , so investigate and determine the value of  $a, b, c$ !

**Answer :**

**$a, b, c$  odd**

$$2 + 4 + 6 = 12 \quad 4 + 6 + 10 = 20$$

$$2 + 4 + 10 = 16$$

**There is not any**

Figure 10. Student Answer during Infusing Model Learning (2)

From the answers in Figure 10. students carry out truth-seeking activities when solving these questions. The activity begins with students reading slowly the information in the questions. Then students write down the information that  $a, b,$  and  $c$  are even numbers. During the joint discussion session, students said that '*even plus even plus even is an even number*'. From these answers, it can be seen, students check and look for answers by trying to enter numbers directly. However, the result is always an even number. The last process is the students write down '*nothing*' which concludes that the questions contain incorrect information.

While the mechanism and mental structure of students when solving the problem is that all mental structures have been constructed in their minds, but the

mental mechanisms that are passed are still not all stages, although they tend to be complete. All mental structures have been built by students as evidenced by students being able to build schemas by connecting actions, processes, and objects in their minds. Students can believe that the questions given contain contradiction information so that students do not look for solutions. This also means that the generalization mental mechanism which has not been developed in previous research subjects has now been passed. Students can apply the scheme to a wider range that if there are questions that contain contradiction information, the problem does not need to be solved because it does not have a solution.

### CONCLUSIONS

Based on the results of the study, it can be concluded that students who behave in truth-seeking are still relatively low. The mental mechanism process of truth-seekers or students who carried out truth-seeking activities in this study was not complete even though the entire mental structure, namely actions, processes, objects, and schemas, had all been constructed in their minds. The mental mechanisms built by students in this study were only interiorization, encapsulation, and coordination. One of the efforts that have met the valid and effective criteria in improving the critical thinking process of truth-seekers is the application of the infusion learning model by applying the provision of mathematical questions with contradiction information. So, it can be concluded that the stages of the infusion learning model can help students get used to thinking critically in solving math problems.

From the conclusion of this study, the researcher advises the teacher to apply the infusion learning model that infuses math problems that contain contradiction

information on a regular basis in learning mathematics in the classroom. In addition, teachers should routinely develop questions that require students to get used to checking the truth of all the information in the questions. This will result in the habituation of students to behave critically and develop their critical thinking processes based on mental mechanisms and structures.

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