



Critical Thinking Analysis of Students in Problem Based Mathematics Learning through TBLA

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Abstract

Mathematics is related to numbers and formulas, as well as its abstract nature. So that understanding it is not by memorizing. It requires the ability to solve mathematical problems. In solving mathematical problems it requires critical thinking skills. Problem-based learning is the right way to train students to think critically, so problem-based learning according to the purpose of improving critical thinking. To find out problem-based learning is able to improve students' critical thinking skills, the Transcript Based Lesson Analysis (TBLA) learning analysis method is used. This research is an exploratory qualitative research that aims to describe critical thinking and tendencies in problem-based mathematics learning using TBLA for students in class VIII-D at SMP Negeri 1 Gresik. The supporting instrumens in this study consisted of documentation using an audio-visual recording device and sheets for lesson analysis the TBLA model. From the results of the TBLA analysis, both based on the number of letters and categorization, it can be seen that problem-based mathematics learning tends to be dominated by students. In the results of the TBLA analysis based on the number of letters, it appears that students are active in communicating with other students, only occasionally asking the teacher about things that need more explanation. Likewise, the results of the TBLA analysis based on categorization show that students have critical thinking skills, namely students can show 6 critical thinking indicators in this study, namely focus, reason, inference, situation, clarity and overview.

Keywords: critical thinking, problem-based learning, TBLA

A. Introduction

Mathematics is one of the subjects that must be studied by students because mathematics has an important role in shaping the mindset of students, so that students are expected to have mathematical abilities to be used as problem solving tools (Utami et al., 2018). Mathematics as a means of scientific thinking is needed to develop students' ways of thinking so that they are able to prepare mentally better in dealing with problems in real life (Cahyani, H., & Setyawati, 2016).

Given the importance of mathematics, students must have basic skills in mathematics, especially problem solving skills. According to (Yuliati, 2021) mathematics is one of the subjects that is expected to form students have the ability to solve problems both in mathematics problems and in problems of daily life, so that mathematics has been taught since elementary school education to higher education levels. According to (Gunantara, G., Suarjana, I. M., & Riastini, 2014) states that mathematical problem solving abilities are skills or potentials that students have in solving problems and applying them in everyday life.

But in reality, the mathematical problem solving ability of Indonesian students is relatively low. This is evident from the results of the 2018 PISA study, where Indonesia is ranked 73 out of 79 countries with an average math ability score of 379 (Tohir, 2019). The low mathematical problem solving ability of students is caused because mathematics is abstract and some teachers in learning are more dominating or teacher-centered. In line with the opinion (Siregar, 2019) the low mathematical problem solving ability of students is caused by learning methods that are still teacher-centered, where teachers more often use the lecture method in the learning process. So that the teacher during learning does not provide opportunities for students to be able to develop their ability to solve problems. According to (Hali, 2016) it is not mathematics that is difficult to learn but because the learning applied does not match the needs and is not meaningful for students. Even though one of the characteristics of learning in the 21st century is that teachers should apply 4C learning, namely Critical thinking, Creative, communicative and collaboration (Fauziyah, 2021). According to (Badjober & Purwaningrum, 2018) mathematics learning according to the 21st century emphasizes the importance of developing four abilities which include creativity, critical thinking skills, collaboration and communication skills. Therefore, in the above problems, critical thinking skills are needed in solving mathematical problems.

Critical thinking skills are basic skills in solving problems (Zubaidah, 2019). There are several definitions from experts regarding critical thinking as follows; Based on (Ennis, 2011) critical thinking is reasonable and reflective thinking that focuses on deciding what to believe or do" which means critical thinking is reasonable and reflective thinking that focuses on deciding what to believe or do. Indicators of critical thinking skills described by (Ennis, 2011) last revision, researchers only used six of the fifteen critical thinking skills, namely (1) Focus, Identify the main focus or attention or students understand the problem in the given problem, (2) Reason, Identify and assess reasons or Students provide reasons based on relevant facts/evidence at each step. (3) Inference, assessing the quality of conclusions, assuming the reasons will be accepted or students make conclusions correctly and students make choices. (4) Situation, pay close attention to the situation or students use information that is appropriate to the problem (5) Clarity, to make sure the language is clear or students provide further explanations. (6) Overview. Check back or rewind and see everything in its entirety or students double-check thoroughly from start to finish. Based on (Agustyaningrum, 2014) Critical thinking is an active process in thinking about something in depth, asking questions to yourself, finding information that is relevant to yourself, not just receiving various information from others. From the explanation above, it was found that critical thinking skills must be possessed by students because students are always faced with the problems of life in society so that they require critical thinking skills for problem solving.

One solution to be able to grow critical thinking skills in learning mathematics, especially in solving mathematical problems is to use a problem-based learning model. Problem-based mathematics learning is a learning model that can develop students' critical thinking skills in solving mathematical problems. According to (Yuhani et al., 2018) Problem-based learning is a learning approach that provides problems at the beginning then students are asked to solve the problem, but to be able to solve the problem students need new knowledge. This is also in line with the opinion (Yuniarti, 2016) Problem-based learning is learning that begins by presenting problems in real life, which involves students conducting investigations, explorations, conjectures, and communicating mathematical ideas to understand concepts, principles and

concepts. The problem based learning model according to (Gunantara, G., Suarjana, I. M., & Riastini, 2014) can be developed to place students as the center of learning as evidenced by the results of his research showing that the application of Problem Based learning (PBL) learning models can improve problem solving abilities, namely from Cycle I to Cycle II is 16.42% of the criteria being moderate to high. According to (Ibrahim, 2012) One solution that provides opportunities to achieve the objectives of learning mathematics is problem-based learning. Meanwhile, according to (Susanti, G., & Rustam, 2018) PBL (Problem Based Learning) is a learning method that encourages students to learn and work together to find solutions to problems related to real life. Through problem-based learning, students are expected to focus on problem-solving activities and have broad opportunities to be able to exchange ideas, ideas or opinions with other students so that they gain a new understanding of mathematics that is inserted in the problem so that it is also hoped that in this learning students will be more active than the teacher.

So that problem-based learning is truly in accordance with the learning objectives to improve critical thinking skills, the teacher must prepare well, the alternative is that teachers and other teachers collaborate, this activity is called Lesson Study. Lesson Study is seen as an alternative to overcome the problem of learning practices that have been seen as less effective than conventional ones. According to (Asari et al., 2018) lesson study is collaborative learning between teachers that aims to improve the quality of learning in the classroom. lesson study stages (N. Fauziyah, 2021) namely plan, do, see and redesign. Plan activities are activities carried out in the form of workshops to develop learning tools. The do activity is to carry out learning in class. See activity is an observation activity in the learning process. Furthermore, redesign activities are activities to design learning based on the results of observations. This activity is carried out collaboratively between teachers and lecturers, called lesson study for the learning community (LLC). In this lesson study there is a model teacher on duty and also as a facilitator. The facilitator must be able to motivate students to develop their potential with other students (Fauziyah & Uchtiawati, 2017). In order for the quality of Lesson Study to increase as we expected, we need to conduct an in-depth analysis of learning through observation and recording of learning, then make learning transcripts and analyze them.

Transcript-based Learning Analysis (TBLA) is a transcript-based learning analysis method developed in Japan. This method is believed to be able to justify the success of the learning design planned by the teacher. The analysis carried out in this study is in the form of an analysis of students' critical thinking skills and also an analysis of the problem-based mathematics learning process. Through the analysis of learning the teacher must observe and transcribe the results of the teaching practice process that has been carried out, then analyze the results of the transcript. The results of the analysis of learning transcripts will be important data about how students learn and the efforts needed to improve the quality of learning.

There are several experts who have conducted lesson study research on the TBLA model, namely; (Mutiani et al., 2020) in the study of history learning using the TBLA model Lesson Study, the results prove that in the post-implementation of the TBLA model lesson study, an increase in student activity was found, this can be seen from the quality of the conversations that occurred between teachers and students which increased influenced by the ability of teachers to increase students' learning motivation through the selection of the right apperception. And learning research conducted at one of the junior high schools in Sumedang Regency on the topic of calculating the volume of blocks carried out by (Supriatna, 2018) through TBLA can find ways to teach students to meet the needs of children in facing their lives in the era of the industrial revolution 4.0.

Based on the description above, the researcher concludes that in solving mathematical problems critical thinking skills are needed, problem-based learning is the right way to train students to think critically and to find out what problem-based learning can improve students' critical thinking skills, use the Transcript Based Lesson Analysis learning analysis method. (TBLA). So researchers are encouraged to conduct research on "analysis of students' critical thinking in problem-based mathematics learning through TBLA".

B. Methodology

1. Research Design

The type of research conducted is exploratory qualitative research. This study aims to describe students' critical thinking and tendencies in problem-based mathematics learning using Transcript Based Lesson Analysis (TBLA).

At the research stage used in this study, it was divided into three stages, namely the preparation stage, implementation stage, and data analysis stage. The research subjects were all students of class VIII-D at UPT SMP Negeri 1 Gresik, in determining the research subject, the researcher first conducted discussions with subject teachers who have previously taught in class. because the class is a class that is held by the homeroom teacher of one of the mathematics teachers themselves.

2. Instruments

The data collection method used in this research is the video documentation method during the learning process and the transcription of the conversation during the lesson. In accordance with this type of research, namely qualitative research, the main instrument in this study is the researcher himself (human instrument). While the auxiliary instruments in this study were documentation with an audio-visual recorder and sheets for lesson analysis the TBLA model.

3. Technique of Data Analysis

The analysis in this study uses the Transcript Based Lesson Analysis (TBLA) method. Data reduction was carried out in several stages, such as: making a transcript of the learning activity process that had been documented through an audio-visual recording device, the results of the transcript of the learning process being arranged in a simpler way with good language. analyzing critical thinking skills and students' tendencies in learning by looking at the transcripts.

C. Findings and Discussion

In accordance with the research steps, the activity begins with the preparation of learning designs, implementation of learning, observation and documentation, and reflection. In preparation, the researcher coordinated with the teachers of UPT SMPN 1 Gresik and mathematics education lecturers at the University of Muhammadiyah Gresik to develop learning designs. At the implementation stage of learning there is one teacher who acts as a model teacher and another teacher as an observer and there are several students who assist in collecting data in the form of audio and visual recordings of the learning process activities in the classroom. From these activities, learning design resumes, videos, and reflection notes were obtained. Based on the existing videos, a full transcript was compiled. This complete transcript was used as TBLA material, so that graphs were obtained based on the number of letters and learning graphs based on the categorization of critical thinking abilities.

1. Learning design

The meeting for the seventh learning design will be held on Tuesday, November 9, 2021, from 09.30-11.00 WIB. Followed by 4 mathematics teachers, namely Ms. Mufidatik, S.Pd, Ms. Aslikhatin, S.Pd, Ms. Siti Djuwariyah, S.Pd. and Mr. M.Muis, S.Pd., Mpd and 4 students. The teacher team agreed to choose the SPLDV material to be implemented (open class) in class VIII-D. The learning model used is a problem-based learning model or known as PBL (Problem Based Learning) with the strengthening of numeracy literacy.

The lesson plans are as follows: initial activities, core activities and final activities. In the initial activities such as the teacher greeting, conveying the goal, giving apperception and motivation. In the core activity, students are given task sharing to discuss with a group of friends. In this case, the teacher facilitates discussion in class and directs the process of working on the LKPD sharing task, then after completing the work the group representatives present the results of their work in front of the class. At the end of the activity the teacher provides reinforcement of SPLDV material related to learning objectives.

2. TBLA results

Data collection in this study was assisted by 4 students who served as video and audio recorders during the learning process. Taking photos, audio recordings, and videos is done in such a way that all learning activities in the classroom can be recorded properly. Figure 1. Describes the transcript analysis process according to a predetermined format.

Waktu	Pembicara	Index	Ucapan
detik	Guru/Siswa		
0	G	1	Assalamualikum Wr. Wb
3	S	2	waalaikumusslam wr.wb
6	G	3	anak-anak terimakasih kalian masih setia bergabung dengan tim guru matematika, terima kasih semoga kita masih diberi sehat wal afiat, aamin. Oh ya ada yang tidak hadir
20	S	4	ada
22	G	5	siapa
23	S	6	calista, fahir, zulfikar
29	G	7	Sakit?
32	S	8	Sakit
55	G	9	kurang tahu bu
40	S	10	oh ya semoga teman kita yang Sakit kembali sehat seperti semula. anak-anak hari ini budatik akan menjelaskan materinya mungkin hal baru tapi ada terkaitannya dengan materi yang lalu disini anak-anak akan nanti belajar membuat model matematika dari masalah kontekstual terkait dengan SPLDV, nah SPLDV itu singkatan dari? ada yang tahu?

H	I
Banyaknya huruf	banyaknya huruf pada kalimat guru/siswa
20	20
21	-21
170	170
3	-3
5	5
25	-25
6	6
5	-5
14	14
334	-334

Figure 1. Screenshot of Learning Transcript Format by Number of Letters

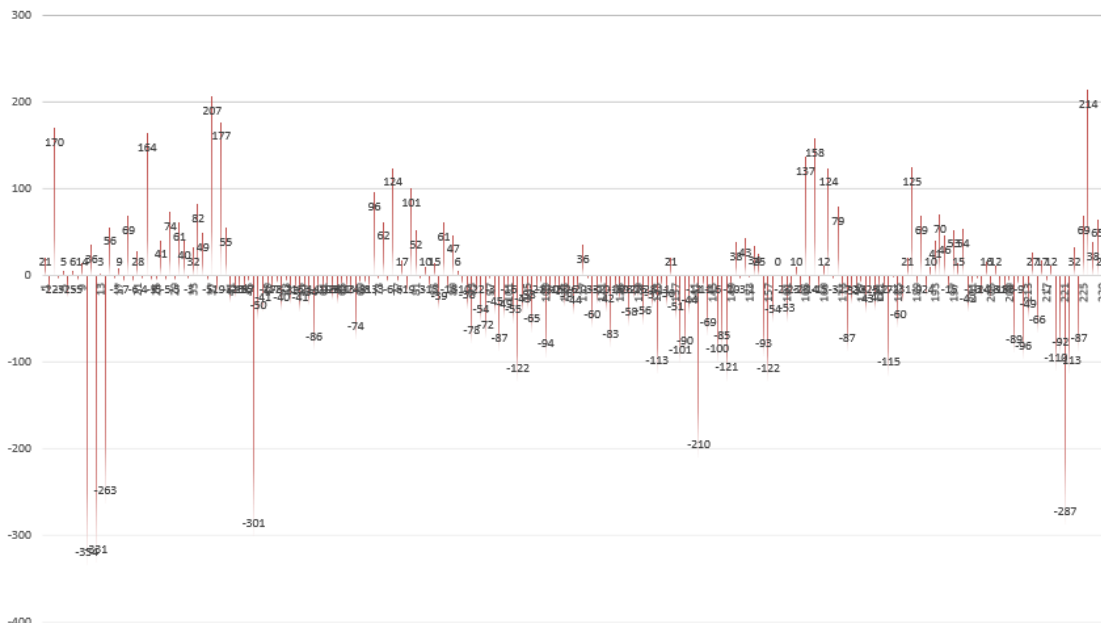


Figure 2. Graph of Learning Transcripts Based on Number of letters

Based on the analysis of the complete transcript, a graph of learning transcripts based on the number of letters was obtained, as shown in Figure 2. The graph in Figure 2 shows the top part is the conversation session carried out by the teacher, while the bottom shows the conversation session carried out by the students. The horizontal line delimiting the conversational sessions between teachers and students on the graph is the indexing of the conversations recorded on the full transcript.

From the results of the learning transcript graph based on the number of letters it can be seen that the conversation at the beginning of the learning activity is dominated by the teacher. Starting from the teacher greeting, conveying learning objectives to apperception activities. Student conversations have started to appear in the core activities until the end of the learning activities, namely during group discussions and presentations of the results of student work. This can be seen in Figure 2, starting from index 41 to 220. At index 220, students are able to present their work in front of the class, so that the number of words produced is more than the previous conversation. So it can be concluded that the learning activities based on the graph in Figure 2 are student-centered learning, where students are active in communicating during the learning process and only occasionally ask the teacher about things that need more explanation.

TBLA results based on categorization communication

Based on the results of the analysis of conversation transcripts during the learning of the SPLDV material on November 9, 2021, TBLA results were also obtained based on categorization. Figure 3. Explaining the transcript analysis process based on categorization according to a predetermined format.

Guru/siswa	Ucapan	Step	KategoriS6si														
			F1	F2	R	I1	I2	S	C1	C2	C3	O					
S6	x nya sepuluh ribu y nya berapa?	1															
S7	oalah ini cari y nya dulu	2															
S6	iya y -nya dulu	3															
S7	x nya sembarang kan ya, bearti $2x + 2y$ Sama sengan seratus empat puluh ribu. $x =$ sepuluh ribu. Berati dikalikan 2 S6ma dengan dua puluh ribu ditambah dua y Sama dengan seratus empat puluh ribu. Dua y S6ma denagan seratus empat puluh ribu dikurangi dua puluh ribu S6ma dengan seratus dua puluh ribu.	6															
S6	terus y S6ma dengan seratus dua puluh ribu per dua	7															
S7	Sama dengan enam puluh ribu	8															
S6	bearti tiket orang dewasa enam puluh ribu	9															
S7	terus ini, X, y,	10															
S7	seratus dua puluh dikurangi S6ma dengan	12															
S8	seratus	13															
S6	bearti tiket orang dewaS6 seratus	14															
S7	x,y nya gimana?	15															
S6	ditulis sepuluh ribu koma enam puluh ribu	16															
S6	bawahe ditulis apa?	17															

Figure 3. Screenshot of categorization of critical thinking indicator description

Based on the analysis of the complete transcript, a graph of learning transcripts was obtained based on categorization, as shown in Figure 4. The graph in Figure 4 shows the categories that emerged in the student learning discussions. In this study, the category used refers to Ennis' thinking category, which can be seen in table 1, in this case the researcher only uses six out of a total of fifteen critical thinking indicators.

Table 1. Critical Thinking Criteria

Critical Thinking Criteria	Critical Thinking Indicator	Description	Code
F (<i>Focus</i>)	Identify the main focus or concern for students to understand the problems in the questions given	Students can write or mention what they know about the problem.	F1
		Students can write down or mention what is being asked in the question.	F2
R (<i>Reason</i>)	Identify and assess the acceptability of the reason or students provide reasons based on relevant facts/evidence at each step	Students are able to write down the steps in solving problems and can provide relevant reasons in making a conclusion	R
I (<i>Inference</i>)	assess the quality of conclusions, assuming the reasons to be accepted or students make conclusions correctly and students choose the right reasons to support the conclusions made	Students draw conclusions correctly.	I1
		Students choose the right reason (R) to support the conclusions made.	I2
S (<i>Situation</i>)	Students use all the information that is appropriate to the problem.	Students are able to find answers by using information that is appropriate to the problem	S1
C (<i>Clarity</i>)	clarity, check to make sure it is clear or the student provides further explanation	Students use further explanations of what is meant in the conclusions made.	C1
		If there is a term in the question, students can explain it.	C2
		Students provide examples of cases that are similar to the problem	C3
O (<i>Overview</i>)	Students research or re-check thoroughly from start to finish (which is produced by FRISC)	Students re-check thoroughly the answers from beginning to end	0

Table 1 above is a table of categorization of indicators of critical thinking skills. Students can be said to have the ability to think critically on the condition that the indicators of critical thinking skills above are met, for the explanation as follows:

- a. F (*Focus*). Identify the main focus or concern or students understand the problem in the given problem. It is said to be focused if students can write or mention what is known about the problem, and also students can write or mention what is being asked in question.

- b. R (Reason). Identify and assess the acceptability of the reason or students provide reasons based on relevant facts/evidence at each step. It is said reason if students are able to write down the steps in solving the problem and can provide relevant reasons in making a conclusion.
- c. I (Inference). Assessing the quality of the conclusions, assuming the reasons to be accepted or students make conclusions correctly and students make choosing the right reason (R) to support the conclusions made. It is said to be inference if students make conclusions correctly, students choose the right reason (R) to support the conclusions made.
- d. S (Situation). Pay close attention to the situation or students use information that is appropriate to the problem. It is said to be a situation if students are able to find answers by using information that is appropriate to the problem.
- e. C (Clarity) Clarity. Check to make sure the language is clear or the student is providing further explanation. As students use further explanations of what is meant in the conclusions made, if there are terms in the questions students can explain them and students provide examples of cases that are similar to the question.
- f. O (overview). Check back or step back and see everything in its entirety or students research, recheck thoroughly from start to finish.

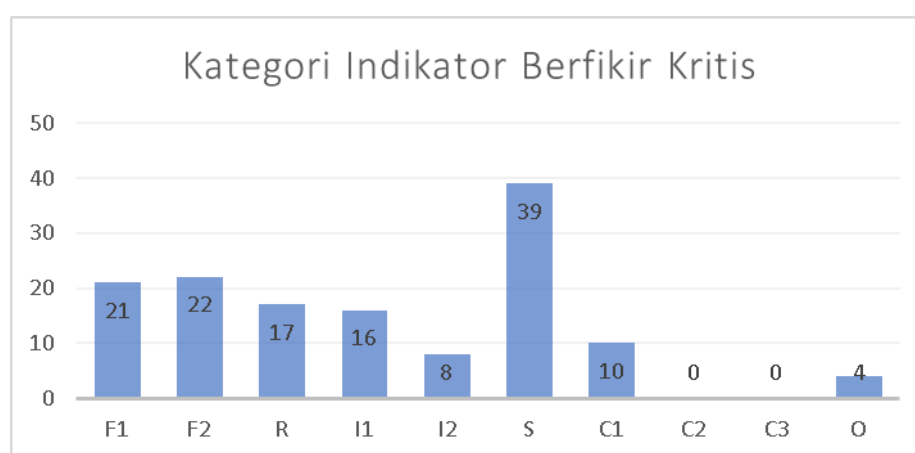


Figure 4. Categorization graph of critical thinking indicator description

Based on the results of the description of the indicator categories in Figure 4, it is known that students in problem-based mathematics learning through TBLA have critical thinking skills as evidenced by the fulfillment of all critical thinking skills indicators.

From a total of 137 student indices, the categorization of students' critical thinking skills was obtained with the following details; focus codes are F1 and F2. F1 as many as 21 indices and F2 as many as 22 indices. The reason code is 17 indexes, the inference code is 16 indexes, the situation code has 39 indexes, the Clarity code has C1, C2 and C3. for C1 as many as 10 indices, and for C2 and C3 with 0 indices. and finally the overview code, namely O, there are 4 indexes. so it can be concluded that students have the ability to think critically in problem-based mathematics learning through TBLA as evidenced by the fulfillment of six critical thinking indicators.

Learning Implementation Results

The implementation of the learning process has basically been well prepared. At the planning stage (lesson planning), all teachers agreed to raise class VIIID as a subject in the implementation of an open class. All the tools and materials needed in the open class are well prepared.

In the do phase (implementation of learning), students look very enthusiastic in learning. Only a few students seem to be less understanding of the learning situation in the open class. At the beginning of learning the teacher provides apperception and motivation for learning activities. and in the core activity the teacher gives LKPD sharing tasks, where in this activity students discuss with group friends to solve the problems in the sharing tasks, the following is an excerpt of a transcript showing how students discuss;

Student 6: how much is the x ten thousand y?

Student 7: oh, look for y first. How to do it?

Student 4: x is arbitrary, right, it means $2x + 2y$ is equal to one hundred and forty thousand. $x =$ ten thousand. Means multiplied by 2 $56ma$ by twenty thousand plus two y Equals one hundred and forty thousand. Two y Equals one hundred forty thousand minus twenty thousand Equals one hundred and twenty thousand.

Student 6: continue y equals one hundred twenty thousand two?

Student 7: Equal to sixty thousand. one hundred twenty minus Equal to?

Student 8: one hundred

Student 6: means a hundred adults

Student 7: how about x, y ?

Student 6: written ten thousand point sixty thousand.

Overall the learning activities went well. The discussion activities showed that all students were active in discussing each other, none of them were dominant. They also help each other.

D. Conclusion

The results showed that the tendency of problem-based mathematics learning based on TBLA results was student-centered learning or as evidenced by student conversations that were more dominant than the upper part of the teacher's conversation session. And students' critical thinking in problem-based mathematics learning based on the results of TBLA students were able to show 6 critical thinking indicators in this study, namely: focus codes F1 and F2. F1 with 21 indexes and F2 with 22 indexes. The reason code has 17 indexes, the inference code has 16 indexes, the situation code has 39 indexes, the Clarity code has C1, C2 and C3. for C1 with 10 indexes, and for C2 and C3 with 0 index. and finally the summary code is O, there are 4 indexes. so it can be concluded that students have critical thinking skills in problem-based mathematics learning through TBLA. because students have the ability to think critically so that students have the ability to write or mention what is asked in the problem, students can write or mention what is asked in the problem, students draw conclusions correctly. Students choose the right reason (R) to support the conclusions made, students are able to find answers by using information that is appropriate to the problem, students use further explanations about what is meant by the conclusions made, students check back carefully the answers from start to finish.

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