

Students' Critical Thinking Skills on Class VIII Materials System of Linear Equations in Two Variables through HOTS-based Learning

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ABSTRACT

Critical thinking skills are needed in facing the world's problems and challenges. The ability to think critically will help in making the right decision. This research is a qualitative descriptive study that aims to describe students' critical thinking skills in material System of Linear Equations in Two Variables of class VIII junior high school through HOTS-based learning. The subjects taken in this study were 6 students from 34 students of class VIII at MTS Al-Ittifaqiah Indralaya. Instruments in the form of 3 HOTS were written test questions material System of Linear Equations in Two Variables that will measure the critical thinking skills of students. Data collection is done through written tests, interviews, and observation results. The average student grade is 29.4. The conclusion is the critical thinking ability of students of class VIII MTS Al-Ittifaqiah Indralaya the results are relatively low.

Keywords: *HOTS-Based Learning, System of Linear Equations in Two Variables, Critical Thinking Skills*

1. INTRODUCTION

System of Linear Equations in Two Variables is one of the mandatory materials that must be mastered by junior high school students, and in this material most of the problems are story-shaped [1], but in reality students still have difficulties in solving System of Linear Equations in Two Variables questions [2].

The ability to think is necessary to face the world's challenges. The skills needed include the ability to think critically, think creatively, and problem-solving skills. The ability to think critically is needed because it will be able to solve various problems that exist in society and personal. Critical thinking skills are needed in mathematics in order to solve mathematical problems appropriately [3]. Critical thinking is shared by everyone, who can be trained, measured and developed [4].

HOTS is a thinking process of students at a higher cognitive level developed from various cognitive concepts and methods and taxonomies such as problem solving methods, Bloom's taxonomy, and taxonomies of teaching, learning, and assessment [5]. According [5],

the main purpose of HOTS is to improve students' thinking skills at a higher level, especially the ability to think critically, receive various information, think creatively in solving a problem.

Based on the advice given [6], in his research that includes two points, namely: 1) *HOTS (Higher Order Thinking Skill)* can be used as a reference for mathematical learning, and 2) further research should examine in detail that has not been reached by researchers. This is also in line with the expectations of the 2013 curriculum [7], where students are required to not only have the ability to level low or *LOTS (Lower Order Thinking Skill)* but also achieve at a high level or *HOTS ability*.

A person who has become accustomed to honing his thinking skills in solving mathematical problems, then a person will be accustomed to thinking logically, critically, guided and consistently [8]. Therefore, students need to practice and get used to or accustomed to being given HOTS-oriented *questions*.

Research conducted by Kamila, etc [6], still lacking detail into aspects of special abilities, they only perform

an analysis of mathematical abilities in solving HOTS problems in material System of Linear Equations in Two Variables. Then the research was conducted by Musafak, etc. [9], they have not applied HOTS-based learning to their learning, they conduct research on students' critical thinking skills in solving HOTS System of Linear Equations in Two Variables material problems based on achievement motivation.

Research Hidayat, etc. [10], states that students do not think critically and students' learning independence is low. Then according to the study [11], it was stated that the three subjects could not fulfill all 6 critical thinking indicators on the material System of Linear Equations in Two Variables.

Therefore, this study will analyze one of the abilities that students must have, namely the ability to think critically. The difference between this research and previous research is that the learning is based on HOTS. This research aims to describe students' critical thinking skills in Class VIII Materials System of Linear

Equations in Two Variables through HOTS-based Learning.

2. METHOD

In this study, the method used is a descriptive method with a qualitative approach. The purpose of this study is to describe students' critical thinking skills in class VIII materials System of Linear Equations in Two Variables through HOTS-based learning.

In this study the subject amounted to 6 students taken in class VIII students at MTS Al-Ittifaqiah Indralaya. Subjects were selected based on the test results, namely 1 student classified as high critical thinking ability, 2 medium ability students, 2 low ability students and 1 student classified as very low ability. The results of the study will be seen is the ability to think critically of students after being given HOTS-based learning. The test results will be analyzed according to the indicators of critical thinking ability can be seen in Table 1, and categorize students based on Table 2.

Table 1. Critical thinking criteria and indicators

Critical Thinking Criteria	Indicator
Interpretation	Understand what the problem is, judging by the way it is written, and asked the answer to the question.
Analysis	Recognize the relationship between statements, questions, and concepts in the problem that are well demonstrated and given a proper explanation
Evaluation	Using good planning in every problem solution, complete, and precise in doing calculations.
Inference	Able to deduce something from the statement addressed.

Table 2. Categorization of students' mathematical critical thinking ability

Interpretation (%)	Categorical Critical Thinking Ability
$80 \leq X \leq 100$	Very high
$60 \leq X < 80$	High
$40 \leq X < 60$	Moderate
$20 \leq X < 40$	Low
$0 \leq X < 20$	Very low

Data collection techniques are carried out by collecting data that can help complete research, namely data in the form of results from interviews, written tests, and interviews. The written test consists of 3 questions containing the cognitive domain of C4 for question number 1, C5 for question number 2, and C6 for question number 3. Data analysis was carried out in the following way. (1) Data Reducing, namely classifying,

organizing, discarding and selecting the collected data to draw a conclusion. (2) Presentation of data (data display), namely clarifying and identifying the incoming data to obtain conclusions. (3) Draw conclusions, namely the data obtained are analyzed and then get conclusions.

3. RESULTS AND DISCUSSIONS

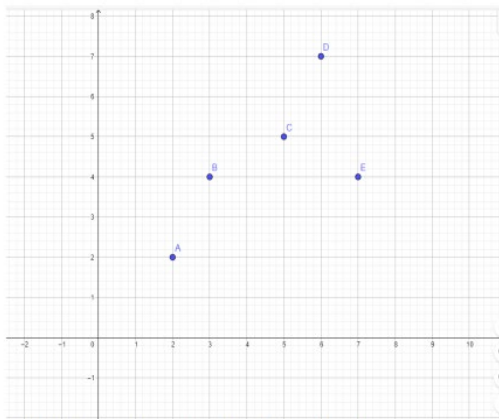
After processing data on the results of the answer to the written test, students' critical thinking skills obtained data calculations, namely the average of their overall grades is 29.4. The acquisition of this average score indicates that students' critical thinking skills fall into the category of low critical thinking skills. As for the maximum value obtained by students as much as 62.5 and the minimum value is 8.3. The results of the student's critical thinking ability data can be seen in Table 3.

Table 3. Data results of students' critical thinking ability

Max	Min	Average	Standard Deviation
62,5	8,33	35,53	14,47

The following are the test questions and answers from 6 students who were the subject of testing students' critical thinking skills on the System of Linear Equations in Two Variables at MTS Al-Ittifaqiah Indralaya.

1. Di sebuah tempat parkir terdapat 70 kendaraan yang terdiri dari mobil dan motor. Jika dihitung roda keseluruhan ada 228 buah. Biaya parkir sebuah mobil Rp.5.000,00 sedangkan biaya parkir sebuah motor Rp.2.000,00. Berapakah jumlah pendapatan uang parkir dari kendaraan yang ada?
2. Nur, Inal, dan Satrio membeli kaos dan topi di toko olahraga yang sama. Nur membeli 1 kaos dan 3 topi dengan membayar Rp.150.000. Inal membeli 2 kaos dan 2 topi dengan membayar Rp.120.000. Satrio juga membeli 2 jenis barang tersebut sebanyak-banyaknya, tetapi ia hanya memiliki uang Rp.100.000. Barang apa saja yang dapat dibeli oleh Satrio dengan uang yang dimilikinya dengan maksimal kembalian Rp.10.000?
3. Perhatikan grafik berikut!



Berdasarkan titik-titik yang ada pada gambar di atas, buatlah:

- a. Persamaan yang memuat sistem persamaan linier dua variabel!
- b. Persamaan yang bukan sistem persamaan linier dua variabel!

Figure 1 Test questions

1. diketahui
 ditempat parkir terdapat 70 kendaraan
 roda keseluruhan ada 228 buah
 biaya parkir sebuah mobil adalah Rp.5000
 biaya parkir sebuah motor adalah Rp.2.000

ditanya
 berapakah jumlah pendapatan yang parkir dari kendaraan yang ada?

jawab
 x = banyak mobil
 y = banyak motor

2. diketahui
 Nur membeli 1 kaos dan 3 topi = 150.000
 Inal membeli 2 kaos dan 2 topi = 120.000

ditanya
 barang apa saja yang dapat dibeli oleh Satrio dengan uang Rp.100.000 dan kembalian 10.000

jawab
 x = kaos
 y = topi

$$\begin{array}{r} x + 3y = 150.000 \quad | \quad \times 2 \quad \rightarrow \quad 2x + 6y = 300.000 \\ 2x + 2y = 120.000 \quad | \quad \times 1 \quad \rightarrow \quad 2x + 2y = 120.000 \\ \hline - 4y = 180.000 \\ : -4 \\ = 45.000 \end{array}$$

$$2x + 45(2y) = 120.000$$

$$2x + 90y = 120.000$$

$$= 120.000 - 90(45)$$

$$= 30.000$$

$$= 30.000 : 2$$

$$= 15.000$$

$$3x + 1y = 100.000$$

$$15x + 45y = 95.000$$

$$= 90.000$$

Jadi Satrio dapat membeli 3 kaos dan 1 topi dengan uang Rp.100.000 dan kembalian 10.000

3. diketahui
 A = 2,2
 B = 3,4
 C = 5,5
 d = 6,7
 e = 7,4

Persamaan titik A dan B

$$\frac{y - y_1}{y_1 - y_2} = \frac{x - x_1}{x_1 - x_2}$$

$$\frac{y - 2}{2 - 4} = \frac{x - 2}{2 - 3}$$

$$= (y - 2)_1 \quad (x - 2)_2$$

Figure 2 Subject DSS

On answer number 1 subject DDS, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. b) Analysis indicators have not been seen, the subject has not been able to make a mathematical model of the

problem. (c) Evaluation indicators have not been seen, the subject has not used the right strategy in every problem solving, it can be seen from the subject not answering the question. (d) Inference indicator have not been seen, the subject has not been able to draw conclusions correctly, This can be seen from the subject who did not write an answer.

On answer number 2 subject DDS, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Analysis indicators have been seen, the subject is able to make a mathematical model of the problem given precisely but there are errors in the explanation, namely in the explanation part of the problem x = The shirt that should be x = Price of 1 shirt and y = the cap should be y = Price of 1 cap. (c) Evaluation Indicator have been seen, the subject is able to use the right strategy in every problem solving, complete, and precise in doing calculations. (d) Inference indicator have been seen, the subject is able to make conclusions precisely, in accordance with the context of the problem and complete.

On subject DDS' answer number 3, (a) Interpretation indicators have been seen, the subject is able to write what is known but does not write what is asked. (b) Indicator analysis has been seen, the subject is able to make a mathematical model of the given problem but it is not quite right. (c) Evaluation indicators have been seen, the subject is able to use the strategy but it is not right and makes mistakes in calculations. (d) Inference indicator has not been seen, the subject has not been able to draw conclusions correctly, This can be seen from the subject who did not write an answer.

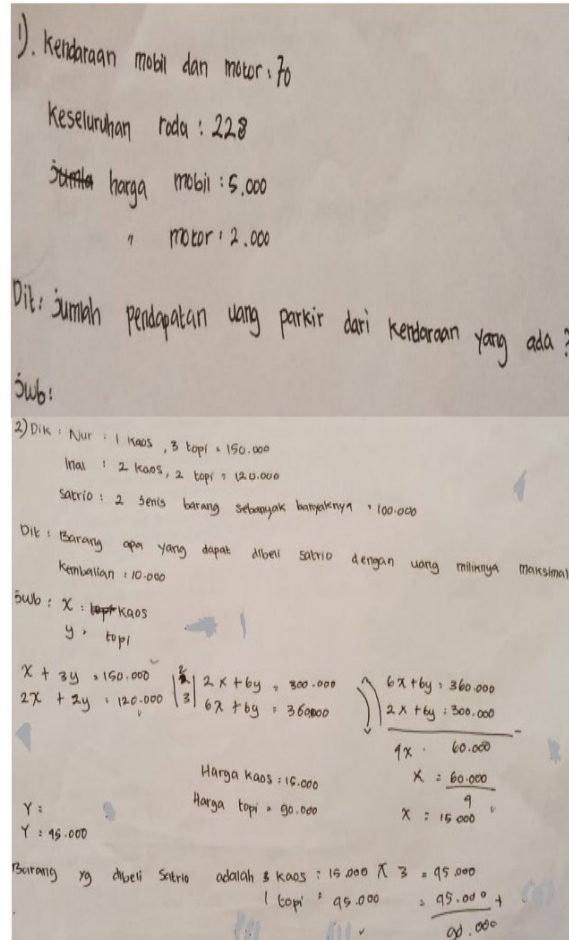


Figure 3 Subject KAK

On subject KAK's answer number 1, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Analysis indicators have not been seen, the subject has not been able to make a mathematical model of the problem. (c) Evaluation indicators have not been seen, the subject has not used the right strategy in every problem solving, it can be seen from the subject not answering the question. (d) Inference indicator has not been seen, the subject has not been able to draw conclusions correctly. This can be seen from the subject who did not write an answer.

On subject KAK's answer number 2, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Analysis indicators have been seen, the subject is able to make a mathematical model of the problem given precisely but there are errors in the explanation, namely in the explanation part of the problem x = The shirt that should be x = Price of 1 shirt and y = the cap should be y = Price of 1 cap. (c) Evaluation Indicator have been seen, the subject is able to use the right strategy in every problem solving, complete, and precise in doing calculations. (d)

Inference indicator have not been seen, the subject is able to draw conclusions correctly, according to with the context of the question and complete, however the language is less prominent.

On subject KAK's answer number 3, the subject has not been able to meet the 4 indicators of critical thinking, judging by the subject not answering the questions.

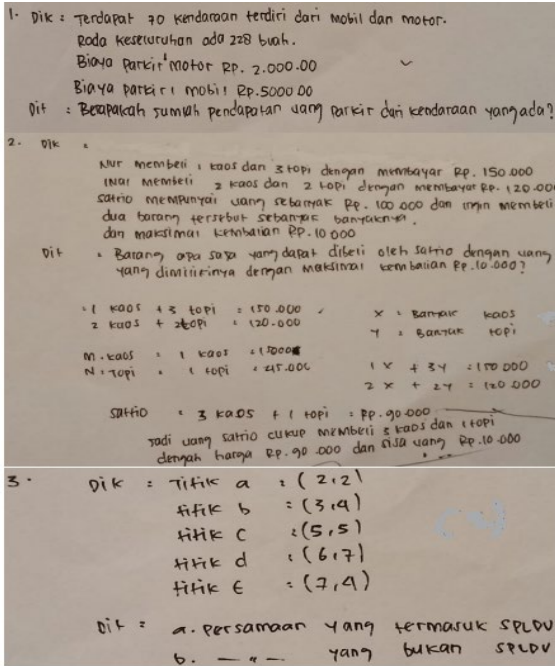


Figure 4 Subject IMI

On answer number 1 subject IMI, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. b) Analysis indicators have not been seen, the subject has not been able to make a mathematical model of the problem. (c) Evaluation indicators have not been seen, the subject has not used the right strategy in every problem solving, it can be seen from the subject not answering the question. (d) Inference indicator has not been seen, the subject has not been able to draw conclusions correctly. This can be seen from the subject who did not write an answer.

On subject IMI's answer number 2, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Analysis indicators have been seen, the subject is able to make a mathematical model of the problem given precisely but there are errors in the explanation, namely in the explanation part of the problem. The x = many shirts that should be x = Price of 1 shirt, and the y = many cap should be y = Price of 1 cap. (c) Evaluation indicators have not been seen, the subject does not write a strategy in solving the problem.

(d) Inference indicator have been seen, the subject is able to make conclusions precisely, in accordance with the context of the problem and complete.

On answer number 3 subject IMI, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Indicator analysis, Evaluation indicators and Inference indicator have not been seen, this can be seen from the subject who did not write an answer.

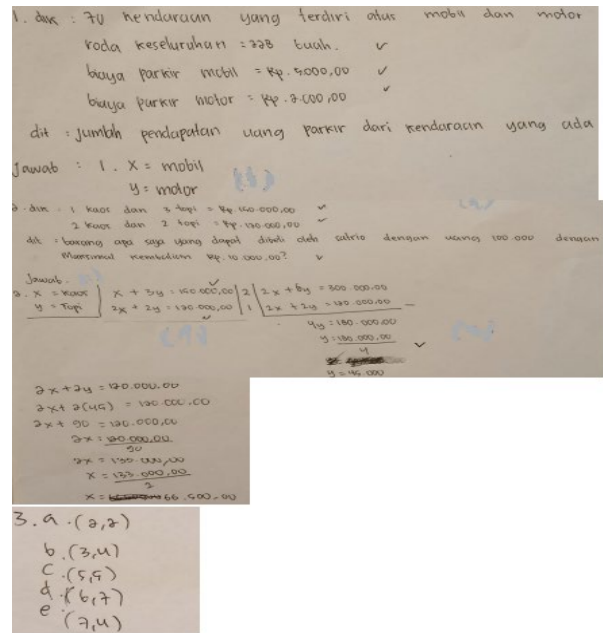


Figure 5 Subject HN

On answer number 1 subject HN, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Indicator analysis, Evaluation indicators and Inference indicator have not been seen, this can be seen from the subject who did not write an answer.

On subject HN's answer number 2, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Analysis indicators have been seen, the subject is able to make a mathematical model of the problem given precisely but there are errors in the explanation, namely in the explanation part of the problem x = The shirt that should be x = Price of 1 shirt and y = the cap should be y = Price of 1 cap. (c) Evaluation indicators have been seen, the subject is able to use the right strategy in every problem solving, complete, but makes errors in calculations. (d) Inference indicator has not been seen, the subject has not been able to draw conclusions correctly. This can be seen from the subject who did not write an answer.

On subject HN's answer number 3, (a) Interpretation indicators have been seen, the subject is able to write what is known but does not write what is asked. (b) Indicator analysis, Evaluation indicators and Inference indicator have not been seen, this can be seen from the subject who did not write an answer.

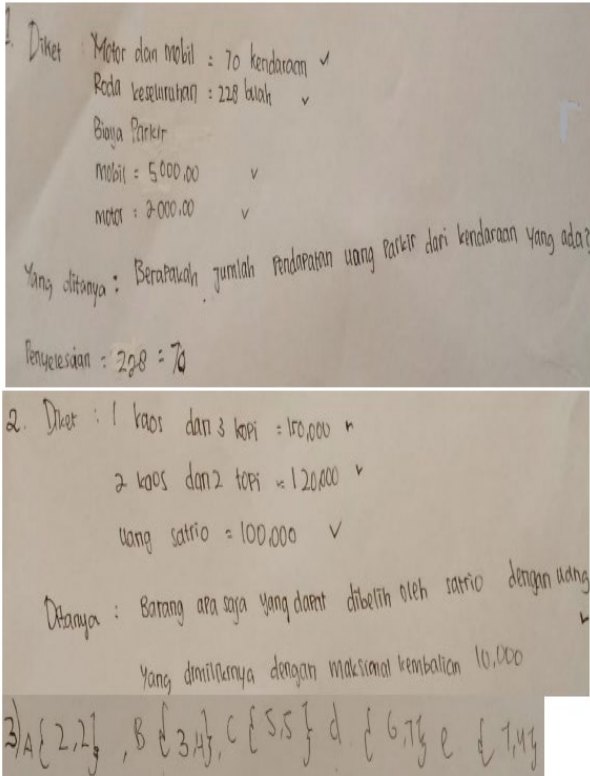


Figure 6 Subject MS

On answer number 1 subject MS, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Indicator analysis, Evaluation indicators and Inference indicator have not been seen, this can be seen from the subject who did not write an answer.

On answer number 2 subject MS, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Indicator analysis, Evaluation indicators and Inference indicator have not been seen, this can be seen from the subject who did not write an answer.

On answer number 2 subject MS, (a) Interpretation indicators have been seen, the subject is able to write what is known but does not write what is asked. (b) Indicator analysis, Evaluation indicators and Inference indicator have not been seen, this can be seen from the subject who did not write an answer.

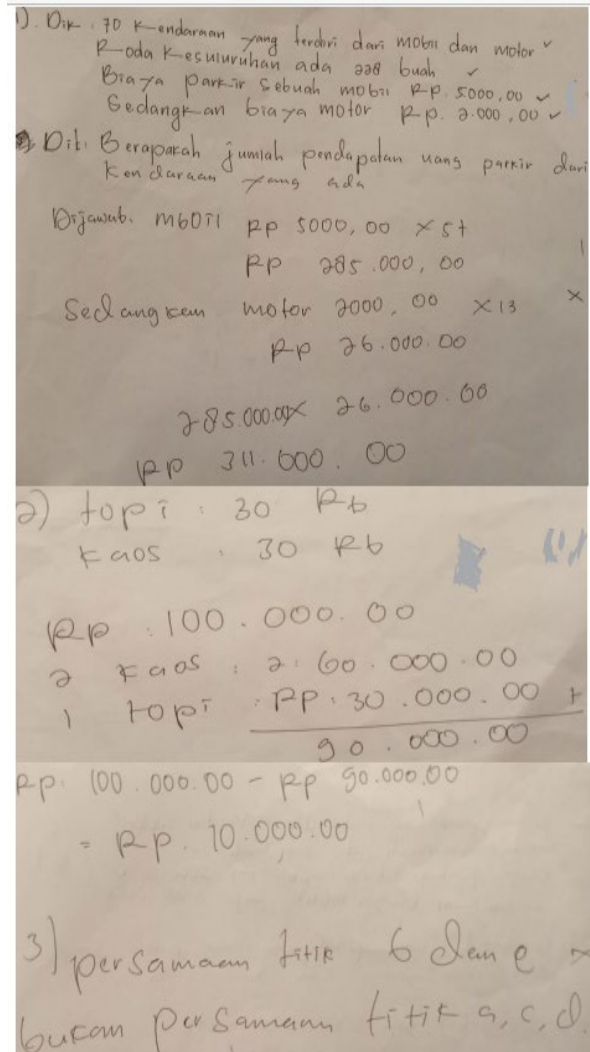


Figure 7 Subject APV

On answer number 1 subject APV, (a) Interpretation indicators have been seen, based on the above completion, the subject is able to write what is known and asked about the question correctly and completely. (b) Analysis indicators have not been seen, the subject has not been able to make a mathematical model of the problem. (c) Evaluation indicators have not been seen, using inappropriate strategies in every problem solving, and incomplete. (d) Inference indicator have not been seen, this can be seen from the subject who did not write an answer.

On subject APV's answer number 2, (a) interpretation indicator has not been seen, based on the completion of the above the subject does not write down what is known and asked about the question. (b) Indicator analysis has not been seen, the subject has not been able to make a mathematical model of the problem correctly. (c) Evaluation indicators have not been seen, using inappropriate strategies in every problem solving, and incomplete. (d) Inference indicator have not been

seen, this can be seen from the subject who did not write an answer.

On subject APV's answer number 3, (a) Interpretation indicators Indicator analysis, Evaluation indicators have not been seen, this can be seen from the subject who did not write an answer. (b) Inference indicator has not been seen, because the subject only writes conclusions without any problem solving.

In question number 1 level C4 (analyzing), students' critical thinking skills are classified as low with an average student score of 38.97. In question number 2 level C5 (evaluating), students' critical thinking skills are classified as moderate with an average student score of 50.73. In question number 3 level C6 (creating), students' critical thinking skills are classified as very low with an average student score of 19.30. Overall, the average score of students on the 3 questions is 35.53, where critical thinking skills are low. The low critical thinking ability in this study was caused by several things, namely the students' unfamiliarity with HOTS questions, and the lack of learning hours to conduct group discussions and conduct class discussions to discuss the correct problem solving.

4. CONCLUSION

Based on the results of research conducted at MTS Al-Ittifaqiah Indralaya, from four indicators of students' critical thinking skills it can be concluded that: 1) Most students already meet 2 indicators, while only a few students are able to meet the next 2 indicators. 2) The average grade obtained from the student's written test results are 35.53, the critical thinking skills of students are low.

It is hoped that further research can maximize learning hours better, and learning hours can be carried out for more than 30 minutes in 1 lesson hour so that group discussions and class discussions can run optimally.

AUTHORS' CONTRIBUTIONS

DL compiles and designs research, M as a validator and checks what DL is compiled and designed. JA, S, and MY as a research team.

ACKNOWLEDGMENTS

Thanks to the validators, Mrs. Kamal and Mrs. Weni, as well as students of class VIII.5 MTS Al-Ittifaqiah Indralaya who are willing to be the subject of research.

REFERENCES

[1] E. L. Resta, M. Munawaroh, Kemampuan Pemahaman Matematis Siswa pada Materi Segiempat, *Jurnal Pendidikan Tambusai* 2(1)

(2018) 1710–1718. DOI: <https://doi.org/10.31004/jptam.v2i3.161>

- [2] P. P. Sari, D. A. Lestari, Analisis Kesulitan Siswa SMP dalam Menyelesaikan Soal Cerita pada Materi Sistem Persamaan Linear Dua Variabel, *Jurnal Cendekia: Jurnal Pendidikan Matematika* 4(1) (2020) 286-293. DOI: <https://doi.org/10.31004/cendekia.v4i1.181>
- [3] F. Kaleiloglu, Y. Gulbahar, The effect of instrumental techniques on critical thinking disposition in online discussion, *Education Technology and Society* 17(1) (2014) 248-258.
- [4] L. Lambertus, Pentingnya Melatih Keterampilan Berpikir Kritis Dalam Pembelajaran Matematika di SD, *Forum Pendidikan* 28(2) (2009) 136-142.
- [5] H. Saputra, Pengembangan Mutu Pendidikan Menuju Era Global: Penguatan Mutu Pembelajaran Dengan Penerapan HOTS (High Order Thinking Skills), Smile's Publishing, 2016.
- [6] A. Kamila, S. Nafisah, D. Aprilia, B. G. Wicaksono, Analisis Kemampuan Siswa SMP dalam Menyelesaikan Soal HOTS Matematika Materi Sistem Persamaan Linear Dua Variabel, in: *ProSANDIKA UNIKAL (Prosiding Seminar Nasional Pendidikan Matematika Universitas Pekalongan)*, Indonesia, 2020, pp. 119-126.
- [7] Permendiknas No. 22 Tahun 2016 Tentang Standar Proses. Depdiknas, Jakarta, 2016.
- [8] B. Wicasari, Z. Ernarningsih, Analisis Kemampuan Berpikir Siswa dalam Menyelesaikan Permasalahan Matematika yang Berorientasi pada HOTS, in: *Prosiding Seminar Nasional Reforming Pedagogy*, 2017, pp. 249-254.
- [9] M. F. Musafak, S. Sunismi, A. Alifiani, Analisis Kemampuan Berpikir Kritis Peserta Didik Dalam Menyelesaikan Soal HOTS pada Materi SPLDV Kelas VIII SMP Negeri 1 Wajak Berdasarkan Motivasi Berprestasi, *Jurnal Penelitian, Pendidikan, dan Pembelajaran* 16(1) (2021) 1-14.
- [10] F. Hidayat, P. Akbar, M. Bernard, Analisis Kemampuan Berfikir Kritis Matematik Serta Kemandirian Belajar Siswa SMP Terhadap Materi SPLDV, *Journal on Education* 1(2) (2019) 515-523.
- [11] A. Anita, R. Ramlah, Analisis Kemampuan Berpikir Kritis Siswa Pada Materi Sistem Persamaan Linear Dua Variabel (SPLDV) Berdasarkan Kemampuan Awal, *MAJU: Jurnal Ilmiah Pendidikan Matematika* 8(2) (2021) 159-167.