



Profile of Critical Thinking Ability of Class VIII Junior High School Students in Science Learning on Simple Aircraft Materials

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Abstract

In this 21st-century educational paradigm, the ability to think critically is one of the life skills that must be possessed to adapt to an increasingly developing life. This study aims to describe the profile of the critical thinking ability of junior high school students in science subjects on Simple Aircraft material. The research method used is descriptive qualitative. Qualitative descriptive research is research that is used to investigate the actual data and is described in the form of words - words or verbally. The subjects in this study were students of class VIII-BIL SMP N 1 Sine with a total of 30 children. The research instrument used in the form of 10 reasoned multiple choice questions (two-tier multiple choice) based on indicators of critical thinking ability according to Facione which is divided into 4 namely (1) interpretation (2) analysis (3) inference (4) evaluation. The results of the study show that students have moderate critical thinking skills, with a percentage of 40%. Meanwhile, based on indicators showing aspects (1) Interpretation has a percentage of 72.3% with a high category (2) analysis has a percentage of 56.7% with a medium category (3) inference has a percentage of 47.8% with a low category (4) evaluation has a percentage 40% with low category. This research is expected to be used as a benchmark for teachers to provide a learning system that encourages students to improve their critical thinking skills by involving students in taking an active role in learning. In addition, this research is expected to provide a reference for similar research or further research.

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INTRODUCTION

In the 21st century, humans are required to have a change in mindset, namely by preparing self-knowledge, especially in the field of education to be able to adapt to a life that is increasingly developing. The 21st century is a century marked by a massive change from an aggressive society to an industrial society and a knowledge society (Roudlo, 2020). In addition, the 21st century is also known as the industrial age and also the age of knowledge in this case all efforts to acquire skills through self-accustoming and also the fulfillment of life in various things based on knowledge (Rifa, 2021).

The field of education is also the impact of developments that must be had in this 21st-century era, which is required to have high-level thinking skills (Husen et al, 2017). These thinking skills include critical thinking skills, problem-solving and creative thinking skills, scientific process skills, and reflective thinking. In line with this, the Ministry of Education and Culture formulated that the 21st-century learning paradigm emphasizes the ability of

students to find out from various sources, formulate problems, think analytically and collaborate and collaborate in solving problems (Ministry of Education and Culture Research and Development, 2013).

According to the OECD (Organization For Economic Co-Operation and Development) in 2018, based on the results of the 2015 PISA (Program For International Student Assessment) test from 70 participating countries, Indonesia was ranked 62nd in the field of science. This shows the low ability of students in Indonesia in the field of understanding science concepts (IPA). The low level of scientific ability can also be seen in the achievement of scientific achievements based on the Trends in Mathematics and Science Study (TIMSS) survey by The International Association for the Evaluation of Educational Achievement (IEA) in 2015 where Indonesia was ranked 44th out of 47 countries with an average score of 397 (IEA, 2016). The scientific ability of Indonesian students is below the average value (500) and is generally at the lowest stage or known as the low international benchmark (Nugraha et al., 2017).

One of the causes of low critical thinking ability in general, namely the learning methods used in schools has not led to training students' critical thinking skills. Students are less encouraged to develop thinking skills in learning activities (Permanasari, 2013). Teachers or educators must apply directive learning methods to train students' critical thinking in learning, especially in science learning. This is done because critical thinking skills are not innate from birth, but must be trained in learning activities by educators as facilitators in the learning (Nurazizah et al., 2017).

Opinions about critical thinking vary widely. Critical thinking is reflective and reasoned thinking centered on making decisions about what to believe or do (Ennis, 2011). Critical thinking is one of the activities that must be owned for the creation of quality natural resources, besides those other competencies that must be mastered are creativity, information, independence, working with teams, independent learning, communication, and creative individuals (Kivunja, 2015). Critical thinking is an intellectual ability in determining a determination or final result with reasonable reasons accompanied by empirical evidence (Yaumi, 2012). According to Febriani (2015) in critical thinking, a person will use logical thinking to determine what must be done with knowledge-based abilities. Critical thinking ability is the ability to think and be able to show evidence of something that can be trusted.

A person's critical thinking ability can be observed based on indicators of critical thinking skills which are explained using phases or behavioral aspects. According to Facione (2013), there are 6 aspects of critical thinking, namely interpretation, analysis, inference/conclusion, evaluation, explanation, and self-regulation. Interpretation is the ability to understand and express explanations based on experiences, events, decisions, and procedures or criteria. The analysis is the ability to identify relationships between statements, questions, concepts, descriptions, or other forms of representation. Evaluation is the ability to judge between statements or representations received and to make reasonable estimates of the relationship between statements, descriptions, questions, and other forms of representation. Conclusion or Inference, namely the ability to identify and obtain the elements needed to draw reasonable conclusions. An explanation is the ability to explain a statement or opinion that has been expressed to become a strong opinion. Self-regulation is the ability to control one of the cognitive activities, the elements used in the activity, and the results obtained, the essence of which is by applying expertise in reviewing and assessing a decision that is concluded that leads to questions, proofs, verifications, and other corrections of one of the reasons.

Critical thinking is an ability that must be possessed as the main provision to face the changing times that are increasingly modern and developing (Agnafia, 2019). A person's critical thinking ability can improve a person's ability to be skilled in analyzing, assessing,

and providing updates about what he thinks in solving a problem, able to grow student learning motivation, student scientific attitude, and student science process skills.

Based on the explanation above, the subject of this research is the critical thinking skills of SMP N 1 Sine class VIII students with the topics presented in the material Business and Simple Aircraft. Students' critical thinking can be formed optimally by requiring interactive classes, students are seen as thinkers not someone being taught, and teachers as mediators, facilitators, and motivators who help students in learning instead of teaching (Paringin et al., 2016). The use of a learning system that tends to be passive makes it difficult for students to understand the material, as evidenced by the results of the previous mid-semester exam, there are still many students who get scores far below the minimum completeness criteria with the highest score of 78 and the lowest getting 20.

This study aims to describe the profile of students' critical thinking skills on each indicator of students' critical thinking skills on business materials and simple machines. This study uses multiple-choice reasoned questions, which involve reasoning at the second level to see students' ability to give reasons and can improve higher-order thinking skills. The questions used are based on Bloom's taxonomy on cognitive abilities C4 - C6. Critical thinking skills can be achieved by someone who has cognitive abilities, this is because in solving problems someone must understand the problem first.

METHODS

This study uses descriptive qualitative research methods, namely research that aims to investigate the actual condition data. According to Sukmadinata (2015), descriptive research is research that aims to describe a situation or phenomenon as it is without manipulating the object of research and is described in the form of words or verbal. Descriptive research aims to obtain an overview of an event that is obtained by scientific and careful observation (Sugiyono, 2017). The subjects of this research are class VIII-BIL students of SMP Negeri 1 Sine, Ngawi with a total of 30 students in the academic year 2021/2022 consisting of 12 male students and 19 female students. This research was conducted in April 2022.

The research instrument used for data collection is a question sheet containing ten questions in the form of two-tier multiple-choice compiled by researchers and has been validated by material experts, namely lecturers and science teachers at SMP N 1 Sine, in addition to the reliability of the test. the level of difficulty and differentiating power are also used as parameter items or tests used (Kurnia, 2021). Based on the analysis of the validity test data of 15 multiple choice questions, it is known that only 10 questions are considered valid. Questions are considered valid if the calculated R-value is greater than r table ($N = 30$, $r \text{ table} = 0.361$). The reliability test of the questions in this study uses the Cronbach alpha coefficient test. The questions are considered reliable if the Cronbach alpha coefficient is above 0.6.

Each question is arranged based on Bloom's taxonomy of cognitive abilities C4-C6, which consists of 3 questions with category C4 with operational verbs analyzing, 4 questions with category C5 with operational verbs, namely concluding and proving, and 3 questions with category C6 with operational verbs. combine.

Reasoned multiple choice questions (two-tier multiple choice) are questions that consist of two levels of questions, the first level is a question that has alternative answers and the second level is the reason for the answer based on the first answer choice. Cullinane (2011) argues that involving reasoning at the second level in the form of two-tier multiple choice questions can be used to see students' ability to give reasons and can improve higher-order thinking skills.

The instrument of reasoned multiple choice questions (two-tier multiple choice) was arranged based on aspects of critical thinking skills according to Facione which was adapted by Normaya (2015) covering aspects of interpretation, analysis, inference, and evaluation.

Meanwhile, other indicators, namely explanation, and self-regulation were not used in this study because according to Facione (2013) the four indicators had fulfilled critical thinking skills, while the explanation and self-regulation indicators were only owned by strong critical thinkers (II & Theory, 2018). The test results are then calculated using the formula:

$$\text{Score} = \frac{\text{Student Earning Score}}{\text{Maximum Score}} \times 100\%$$

The guidelines for scoring the test results for multiple-choice questions are shown in Table 1.

Table 1. Scoring of Reasoned Multiple Choice Questions

Number	Assesment Criteria		Score
	Answer	Reason	
1	True	True	3
2	False	True	2
3	True	False	1
4	False	False	0

(Source : Yamtinah, dkk.,2016)

The results of the study were then categorized according to the criteria for achieving critical thinking skills according to Riduwan (2013). The grouping of criteria consists of very high, high, moderate, low, and very low. Categorization of critical thinking ability criteria can be seen in Table 2 .

Table.2 Categories of critical thinking skills

Number	Percentage	Category
1	81 - 100	Very high
2	61 - 80	Tall
3	41 - 60	Curently
4	21 - 40	Low
5	0 - 20	Very Low

(Source ; Riduwan, 2013)

RESULTS AND DISCUSSION

Based on the research that has been done, students of class VIII - BIL at SMP Negeri 1 Sine on the material of Simple Business and Aircraft have a level of critical thinking ability in the medium category, namely with a percentage of 40% which means as many as 12 students out of 30 students have a level of critical thinking ability. currently. This is to research by Agnafia (2019) and A'yun (2020) which shows that students' critical thinking skills in Indonesia are still in the medium category. The learning system applied in schools is still teacher center and the use of learning methods and models that are less than optimal in shaping students' activeness and thinking power. The results of students' critical thinking skills based on tests can be seen in Figure 1.

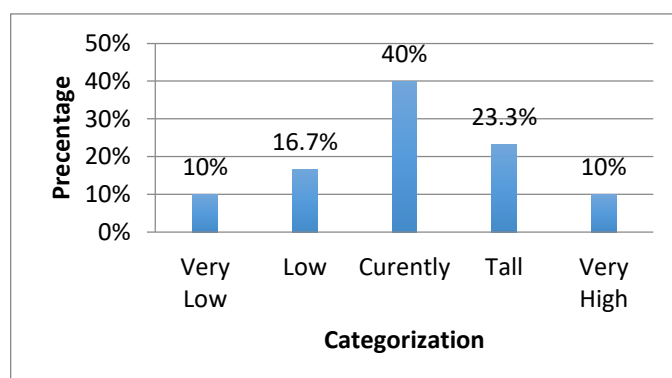


Figure 1. Percentage of Students' Critical Thinking Ability

Data on students' critical thinking ability test results for each indicator can be seen in Table 3.

Table 3. Percentage of Students' Critical Thinking Ability per Indicator

Indicator	Question Number	Total Student Score	Percentage	Category
Interpretation	5,8,9	65	72,3%	High
Analysis	1,3,7	51	56,7 %	Curently
Evaluation	2,10	43	47,8 %	Low
Inference	4,6	36	40 %	Low

Interpretation Ability Indicator

According to Facione (2010), Interpretation ability is the ability to understand and explain the meaning of the problem based on experience, events, decisions, and procedures or criteria. Students are expected to be able to write down what is asked in the question clearly and precisely. Students are given 3 questions with Interpretation indicators, one of which in question number five students are given several problems with activities in daily life, then students are asked to show and provide explanations for the problems of these activities by linking the application of business concepts and simple machines. Students' ability to answer questions based on interpretation indicators is shown in Figure 2.

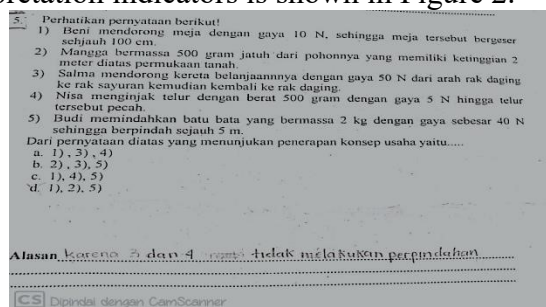


Figure 2. Students' ability to answer questions on interpretation indicators

Based on the results of research findings on indicators of interpretation ability, 21 students answered correctly and only 4 of them were able to give reasons correctly. Students who can give correct answers and write reasons based on the theory of work, namely an activity can be said to be doing work if there is a force acting and there is a displacement. The statement in the question that shows the business is in statement number 1, and 2,5, while in statements 3 and 4 it is not said to be a business because the activity carried out is not accompanied by a transfer.

The analysis of the calculation and categorization of the indicators of interpretation ability can be seen in Table 4.

Table 4. Analysis of Calculation and Categorization of Interpretation Indicators

Number of Question	Students Who Answer	Percentage	Average Presentation	Category
5	21	70 %		
8	20	66,7 %	72,3%	High
9	24	80 %		

Table 4 shows that the student's ability to think and write clearly and accurately is included in the high category, which shows a percentage of 72.3%. This is because the

questions given are related to examples of application in everyday life, so they can understand the essence of the questions and can answer even though many of them are not appropriate to describe the explanation. Problems that arise in questions (question instruments) measuring critical thinking skills and problem-solving should be problems related to phenomena in everyday life or the form of conceptual problems (Rosdiana, 2020).

Analysis Ability Indicator

An indicator of analytical ability is the ability to be able to identify and draw conclusions about the relationship between questions, statements, concepts, descriptions, or other forms. There are 3 questions given to students on this analysis indicator. One of them is in question number 3, with the correct calculation category students are described several people who have different pushing forces to move a table that weighs 25 kg to be moved 12 meters and the frictional force is 150 N so 6600 J of work is required. The student's ability to answer questions on the Analysis indicator is shown in Figure 3.

3. Lima orang mempunyai gaya dorong sebagai berikut!

No	Nama	Gaya Dorong
1	Budi	150 N
2	Yogi	200 N
3	Rudi	250 N
4	Bagas	300 N
5	Rizki	100 N

Untuk memindahkan meja yang massanya 25 kg sejauh 12 meter dengan gaya gesek 150 N diperlukan usaha sebesar 6600 J. Orang yang tepat untuk mendorong meja tersebut adalah.....

a. Budi, Yogi, dan Rudi
 b. Bagas, Rizki, dan Budi
 c. Budi, Rudi, dan Bagas
 d. Yogi, Budi, Rizki.

$f = \frac{W}{C} + f$

A. Budi, Yogi, Rudi = 600
 B. Bagas, Rizki, Budi = 600
 C. Budi, Rudi, Bagas = 700
 D. Yogi, Budi, Rizki = 450

Alasan: $f = \frac{6600}{12} + 150 = 700$

Figure 3. The ability of students to answer questions on the ability of analysis

Students were asked to analyze the calculations on the questions given and the results obtained were 14 children who answered correctly and only 4 students were able to explain correctly according to the formula. The thrust required to push the table can be found by the equation of the required effort divided by the distance traveled and added with the frictional force so that a force of 700 is produced. So that the right person who produces the appropriate thrust is in answer C. Analysis of calculations and categorization of the ability indicators The analysis is shown in table 5.

Table 5. Analysis of Critical Thinking Ability Analysis Indicators

Number of Question	Students Who Answer	Percentage	Average Presentation	Category
1	21	70 %		
3	14	46,7 %	56,7 %	Curently
7	16	53,4 %		

Table 5 shows that the critical thinking skills in the analysis indicators are in the medium category, with a percentage of 56.7%. This is because not all students master the formula, there are only a few children who know the formula without knowing the meaning and flow of the calculation. Students' basic skills can be built by applying discovery-based learning activities (inquiry) (Duran, 2016).

Inference Ability Indicator

Indicators' Inference ability is the ability to investigate and obtain elements that are used to obtain logical/reasonable conclusions. Students are given 2 questions that contain inference indicators, namely numbers 2 and 10. In this study, students were asked to use logic and put forward conjectures to conclude. One example of a question form is that in number 2 students are given a problem with two people with a period of fixing the roof tiles by taking

turns climbing stairs but having a different period. The ability of students to answer questions on the Inference indicator is shown in Figure 4.

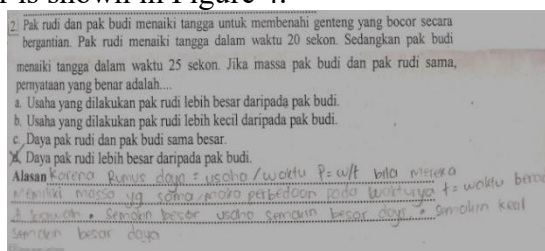


Figure 4. Students' ability to answer questions on inference indicators

The question was answered correctly by 21 students and only 5 students were able to provide an appropriate explanation. The correct statement is shown in answer D. The difference in the problem only lies in the time it takes, the greater the time it takes, the smaller the power, and vice versa, because power is the result of work divided by time. The analysis of counting and categorizing the indicators of inference ability is shown in Table 6. The questions were answered correctly by 21 students and only 5 students were able to provide an appropriate explanation. The correct statement is shown in answer D. The difference in the problem only lies in the time it takes, the greater the time it takes, the smaller the power, and vice versa, because power is the result of work divided by time. The calculation analysis and categorization of the inference ability indicators are shown in Table 6.

Table 6. Analysis of Critical Thinking Ability Inference Indicator

Number of Question	Students Who Answer	Percentage	Average Presentation	Category
2	21	70 %	47,8 %	Low
10	22	73,4 %		

Table 6 shows the percentage of the Inference indicator in the low category because it shows a number below 50%, namely with a percentage of 47.8%. This is due to the lack of understanding of sentences that students get in understanding the concept of the material so students need to be trained to gain knowledge.

Evaluation Ability Indicator

Evaluation indicators are the ability to access the credibility of statements or representations and to reasonably assess the relationship between statements, descriptions, questions, and other forms of representation. Students must use the right strategy in solving problems completely and doing calculations correctly. Question number 6 students are given problems by solving simple airplane problems with the right strategy so that the lever position remains balanced when the fulcrum is shifted closer to a load that has a certain weight. The student's ability to answer questions on the Evaluation indicator is shown in Figure 5.

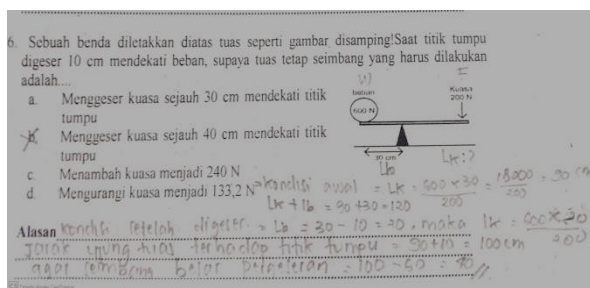


Figure 5. Students' ability to answer questions on the Evaluation indicator

A total of 20 students were able to answer correctly and only 5 children were able to give reasons correctly. The position of the lever so that it is balanced can be determined by knowing the length of the lever in advance, and by adding up the value of the power arm () and the load arm (). The load arm () is known to have a value of 30 cm while the power arm () can be found with the equation $w \cdot l = F \cdot l$, so that the result is 90. So the length of the lever is known to have a length of 120 cm. The condition of the fulcrum after being shifted 10 cm close to the load, so that the new load arm () is 20 cm and the power arm () is 60 cm. In the problem due to the shift in the fulcrum, the distance between the tip of the right lever to the fulcrum becomes 90 plus 10 cm, so to see how far the power must move closer to the fulcrum so that the lever remains balanced, it is connected to a new power arm. So, the point of force must be moved closer to the fulcrum to keep the lever balanced the magnitude of the shift is $100 - 60 = 40$ cm.

The analysis of calculation and categorization of evaluation capability indicators is shown in Table 7.

Table 7. Analysis of Critical Thinking Ability Evaluation Indicators

Number of Question	Students Who Answer	Percentage	Average Presentation	Category
4	16	53,4 %	40 %	Low
6	20	66,7 %		

Table 7 shows the percentage of 40% so it is in a low category. This is because there are still many students who do not understand the statement of the desired question and have not been able to give reasonable conclusions.

Students' critical thinking ability can be determined by how they respond to the problems they face. In addition, they are active in asking questions to get accurate information, working on questions seriously to get reasonable answers, daring to give opinions and logical ideas, and based on mathematical explanations they can conclude. This research is in line with A'yun's research (2020) where the highest percentage lies in the interpretation indicator or the ability to provide a simple explanation, which both show results above 70% in the high category.

CONCLUSION

Based on the results of the research and the description above, it can be concluded that the level of critical thinking skills of students at SMP Negeri 1 Sine is in the medium category. Students' critical thinking ability can be influenced by several factors including lack of thoroughness in working on the given questions, lack of understanding of the concepts of the material they receive, and the perceived bias of students towards the questions.

SUGGESTION

Suggestions for researchers are expected in this study can be used as lessons for better research in the future. For teachers of the science study program, they should provide a learning system that involves students playing an active role and being able to encourage them to improve their critical thinking skills. Students are expected to be able to do self-evaluation in learning activities and be more thorough in working on the questions given.

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REFERENCES

- A'yun, Qurrota.(2020). Profil Ketrampilan Berpikir Kritis Siswa Smp Dalam Pembelajaran Ipa Pada Materi Tekanan Zat. *Jurnal Penelitian Pendidikan Sains*, 9 (2) :1804-1811.
- Afandi, Tulus J., dan Rachmi A. (2016). Implementasi DigitalAge Literacy dalam Pendidikan Abad 21 di Indonesia. *Seminar Nasional Pendidikan Sains*. Surakarta.
- Agnafia, Desi Nuzul. (2019). Analisis Kemampuan Berpikir Kritis Siswa Dalam Pembelajaran Biologi. *Florea*.6(1): 45-53.
- Cahyaningati, Endah Nur.(2020). Kemampuan Berpikir Kritis Siswa SMP Dalam Menyelesaikan Soal *Open Ended* Ditinjau Dari *Adversity Quotient (AQ)*. *Skripsi*. Mojokerto : Jurusan Pendidikan Matematika Universitas Islam Majapahit.
- Cullinane, Alison dan Maeve Liston. (2011). *Two-tier Multiple Choice Question: An Alternative Method of Formatif Assessment for First Year Undergraduate Biology Students*. *Limerick: National Center for Excellence In Mathematics and Education Science Teaching and Learning (NCE-MSTL)*.
- Duran, M., & Dökme, I. (2016). The Effect Of The Inquiry-Based Learning Approach On Student's Critical-Thinking Skills. *Eurasia Journal of Mathematics, Science & Technology Education*, 12 (12), 2887-2908.
- Ennis, Robert.H. (2011). *The Nature of Critical Thinking: An Outline of Critical Thinking Dispositions and Abilities*. *Emeritus Professor, University of Illinois Last Revised, May, 2011*.
- Facione, A.Petter. (2013). *Critical Thinking: What It Is and Why It Counts*. *Measured Reasons and The California Academic Press, Millbrae, CA.*
- Febriani, Nurul. (2015). Kemampuan Berpikir Kritis Siswa Ditinjau Dari Gaya Berpikir Dalam Menyelesaikan Soal Matematika Kelas VIII SMPN 1 Ngunut Tulungagung Tahun Ajaran 2014/2015. *Skripsi*. Tulungagung: Jurusan Tadris Matematika IAIN Tulungagung.
- Husen, A., Indriwati, S.E., & Lestari, U. (2017). "Peningkatan Kemampuan Berpikir Kritis Dan Keterampilan Proses Sains Siswa Sma Melalui Implementasi Problem Based Learning Dipadu Think Pair Share". *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, Vol.2 No.6, Hal 853-860.
- IEA. (2015). *Student Achievement Overview (Science) Grade 4*. <http://timss2015.org/timss-2015/science/student-achievement>
- Kivunja, Charles. (2015). Teaching Student To Learn And To Work Well With 21 Century Skills: Unpacking The Career And Life Skills Domain Of The New Learning Paradigm. *International Journal Of Higher Education*. 4(1): 2-11.
- Kurnia, Alifia., dkk. (2021). Profil Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Pilihan Ganda Pada Pembelajaran Ilmu Pengetahuan Alam. *Indonesia Journal of Education Science (IJES)*, 4 (1), 27 -23.
- Luchmayanti, Wafda .(2019). Profil Kemampuan Berpikir Kritis Siswa Dalam Menyelesaikan Masalah Kontekstual Geometri Bertemakan Gudang Atag. *Skripsi*. Jember : Jurusan Pendidikan MIPA Universitas Jember.
- Maslakhatunni'mah, Dewi.(2019). Analisis Kemampuan Berfikir Kritis Siwa Pada Mata Pelajaran Ipa Kelas VII SMP. *Seminar Nasional Pendidikan Sains*.Surakarta
- Normaya, Karim. (2015). Kemampuan Berpikir Kritis Siswa Dalam Pembelajaran

- Matematika Dengan Menggunakan Model Jucama Di Sekolah Menengah Pertama, *EDU-MAT Jurnal Pendidikan Matematika*, Volume 3, Nomor 1, April 2015, hlm 92 – 104.
- Nugraha, A, J., Suyitno, H., & Susilaningsih, E. (2017). Analisis Kemampuan Berpikir Kritis Ditinjau Dari Ketrampilan Proses Sains Dan Motivasi Belajar Melalui Model PBL. *Journal of Primary Education*, 6(1), 35 - 43
- Nurazizah, S., Sinaga, P., & Jauhari, A. (2017). Profil Kemampuan Kognitif Dan Ketrampilan Berpikir Kritis Siswa SMA Pada Materi Usaha Dan Energi. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, 3(2), 192-202.
- OECD(Organization For Economic Co-Operation And Development). (2018). *Pisa 2015 Results In Focus*. Retrieved From www.Oecd.Org/Pisa/Pisa-2015-Results-In-Focus.Pdf.
- Paringin, S., Mata, P., & Ipa, P. (2016). Analisis Kemampuan Berpikir Kritis Siswa Kelas Ix. *Prosiding Konferensi Nasional Penelitian Matematika Dan Pembelajarannya, 2006*, 179–186
- Permanasari, V., 2013. Efektivitas Pendekatan Pembelajaran Open-Ended Terhadap Kemampuan Berpikir Matematis Siswa Pada Materi Trigonometri Ditinjau Dari Kreativitas Belajar Matematika Siswa. *Jurnal Pendidikan Matematika Solusi*, 1(1): 1-7.
- Rosdiana, S.R.(2020). Kemampuan Berpikir Kritis Siswa dalam Pembelajaran Inquiry-Discovery. *Science Education and Application Journal*, 2(2), 101
- Roudlo, M.P (2020). Kemampuan Berpikir Kritis Dan Kemandirian Belajar Melalui Model Pembelajaran Flipped Classroom Dengan Pendekatan STEM. *Prosiding Seminar Nasional Pascasarjana*, 20
- Sugiyono. (2009). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta
- Sukmadinata, N. S. (2015). *Metode Penelitian Pendidikan*. Bandung: PT Remaja Rosdakarya.
- Yamtinah, S., Dkk.(2016). *Item Discrimination of Two Tier Test. Proceeding Internasional Conference on educational Research and Evaluating (ICERE)*. 29-31 May 2016, Yogyakarta State University
- Yaumi, Muhammad. (2012). *Pembelajaran Berbasis Multiple Intelligences*. Jakarta: Dian Rakyat.
- Rifa, Hanifa Mardhiyah,. Dkk. (2021). Pentingnya Ketrampilan Belajar di Abad 21 sebagai Tuntutan dalam Pengembangan Sumber Daya Manusia. *Lectura : Jurnal Pendidikan*, 12(1), 29 - 40.
- Wijaya, Yuni Etistika,. Dkk. 2016. Transformasi Pendidikan Abad 21 Sebagai Tuntutan Pengembangan Sumber Daya Manusia Di Era Global. *Prosiding Seminar Nasional pendidikan Matematika*, Malang.
- Kemendikbud. *Penyelenggaraan Pendidikan Sistem Ganda pada Sekolah Menengah Kejuruan*. Jakarta: Direktorat Pendidikan Menengah Kejuruan.