Journal of General Education and Humanities
Vol. 2, No. 4, November 2023, pp. 247 – 262, https://doi.org/10.58421/gehu.v2i4.70
ISSN 2963-7147

Critical Thinking Ability in Solving Word Problems Based on David Kolb's Learning Style

Nur Juhainah Ulfa[1], Dian Permatasari[2]
[1,2]Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Indonesia

Article Info

Article history:

Received 2023-02-06
Revised 2023-05-09
Accepted 2023-07-12

Keywords:

Critical thinking
Word problems
Learning styles

ABSTRACT

This study aims to describe students' critical thinking skills in solving word problems based on David Kolb's learning style. The type of research is descriptive qualitative research conducted at MAN in Bantul using purposive sampling. The data collection techniques in this study were critical thinking skills tests, learning style questionnaires, and interviews. The data analysis used is condensation, data presentation, and conclusion Drawing. The results show that students' three learning styles are diverger, assimilator, and converger. Students' critical thinking skills in divergent learning styles are medium and low. The diverger student can master the average indicators of interpretation, analysis, evaluation, inference, and explanation but cannot meet the self-regulation indicators. The student's critical thinking skills with assimilator learning style are high, medium, and low. Students with high and moderate can master all critical thinking indicators, but low assimilator students can master the indicators of interpretation, analysis, evaluation, inference, and explanation. The student's critical thinking ability with a converger learning style is medium and low. Medium converger students can master all critical thinking indicators. Low converger students can master the indicators of interpretation, analysis, evaluation, inference, and explanation but are less able to meet the self-regulation indicators.

This is an open-access article under the CC BY-SA license.

Corresponding Author:

Nur Juhainah Ulfa
Fakultas Ilmu Tarbiyah dan Keguruan, Universitas Islam Negeri Sunan Kalijaga
Email: juhainah2018@gmail.com

1. INTRODUCTION

Education can create critical and independent human resources and has qualities that can increase the overall selling value because it is the primary capital to get quality human beings [1]. In education, critical thinking skills are necessary for students [2]. Efforts to improve critical thinking skills in mathematics are rarely developed in applying the learning process in the classroom. Critical thinking is a student's ability to think in a process that analyzes, connects, and creates all aspects of a given situation or problem.

Students can think critically if students can conclude known information, use available information to solve problems, and students can find sources of information to solve problems [3]. Critical thinking is a persistent effort to test something believed to be accurate or knowledge with supporting evidence to draw further appropriate conclusions [4]. Critical thinking in learning mathematics is a person's cognitive process to acquire mathematical knowledge based on mathematical reasoning [5]–[9]. Critical thinking is the ability to analyze and evaluate information obtained from observation, Experience, reasoning, and communication to decide whether this information can be trusted so that it can provide rational and correct conclusions [10]. Thus, critical thinking is a cognitive process for analyzing, connecting, and creating information to test something believed to be accurate or knowledge with supporting evidence to draw further conclusions.

Critical thinking is a high-level thinking skill that has several indicators. Peter A Facione suggests six indicators of critical thinking skills including [11], namely 1) Interpretation is the ability to be able to understand and express the meaning or meaning of a problem; 2) Analysis is the ability to be able to identify and conclude relationships between statements, concepts, descriptions, or other forms; 3) Evaluation is the ability to be able to access the credibility of statements or representations and be able to logically access the relationship between statements, descriptions, and concepts; 4) Inference is the ability to be able to identify and get the elements needed in Concluding; 5) Explanation is the ability to determine and give reasons logically based on the results obtained, and 6) Self Regulation is the ability to monitor one's cognitive activity, the elements used in problem-solving activities, especially in applying the ability to analyze and evaluate.

Critical thinking ability is a high cognitive competency that needs to be mastered by students, both at the elementary school and university levels [12]. One of the general goals of learning mathematics in schools is to prepare students to develop mathematical abilities, train ways of thinking and reasoning in conclusion, use mathematical ideas in everyday life, and study various sciences [13]. Thus, developing critical thinking skills is very important to achieve the objectives of learning mathematics and prepare students to use their way of thinking in seeking other knowledge and everyday life [14], [15]. People who think critically can conclude what they know, know how to use the information to solve problems, and find relevant sources [16]. Critical thinking can be developed while learning mathematics because mathematics is a systematic and structured science to develop an attitude of critical thinking [17]. The ability to think critically is the skill of issuing arguments with logical reasoning [18]. Logical reasoning is based on high-level thinking and insight into understanding each meaning of the problem. Critical thinking skills are part of what needs to be optimized through the learning process at school [19].

Find out students' critical thinking skills in doing math problems, and this can be done by teachers, one of which is identifying students' critical thinking skills when solving problems [20]. Therefore, educators must observe students when solving problems because there is a relationship between critical thinking and how to solve problems [21]. One problem-solving activity is solving math word problems [22], [23]. Students' critical thinking skills can be seen when given verbal questions or problems. Verbal ability positively affects students' ability to solve word problems. It can be interpreted that the

better or higher the verbal abilities possessed by students, their ability to solve word problems will be better or higher [24]. In addition, good verbal skills impact the results of good story problem-solving [25].

Word problems are stated in meaningful and easy-to-understand sentences [26]. Word problems tend to be more challenging to solve than questions that only contain numbers [27]. When solving word problems, students need to understand the content of the word problem, know the mathematical objects that need to be solved, and transform them into mathematical models. Then you must choose the correct arithmetic operations to solve word problems up to the last level: completion and withdrawal conclusion [28]. Word problems are part of the difficulties faced by students in problem-solving. One of the causes of students' inability to work on word problems is that they do not understand what is known and what is being asked in the question. The difficulty in determining the solution is not due to the students not mastering the steps in solving a story problem but more likely to the student's difficulty in interpreting the questions and the sign operations they must use in solving the problem [24]. The difficulty students face in solving word problems is the way students think. It causes students to be less careful and have difficulty understanding stories, thus affecting students in solving mathematical problems [29].

The difficulties students face in solving word problems can be influenced when teaching and learning, even the students' learning styles. In addition, limited memory causes students to memorize formulas considered meaningful. This way of learning must, of course, be improved, namely by increasing thinking skills [30]. In psychological studies, several factors influence student learning processes internally and externally [31]. Learning style is one of the internal factors that can contribute to the learning process. Each student's learning style must be different in obtaining and processing the information obtained. As one of the internal factors, if the uniqueness of student learning styles is considered, students can develop themselves optimally according to their abilities [32]. In addition, learning styles can also help maximize the learning process. Learning style is one of the factors that affect the level of students' critical thinking skills. Learning styles affect students' thinking and solving problems or questions [33]. There is a positive relationship between learning styles and students' critical thinking skills [34], and learning styles are also a driving factor for achieving critical thinking skills [35].

Experts regarding various learning styles have developed many theories and models. Deporter and Hernacki distinguish learning styles into three types: visual learning styles that tend to be seen, auditory learning styles that tend to listen, and kinesthetic learning styles that tend to move. The learning style of the HBDI (Herrmann Brain Dominance Instrument) model is based on the task specialization function of the parts of the brain, namely quadrant A (left brain, cerebral), quadrant B (left brain, limbic), quadrant C (right brain, limbic), and quadrant C (right brain, limbic). Quadrant D (right brain, cerebral). In addition, the Felder-Silverman learning style developed by RM Felder and LK Silverman consists of five types: sensory, visual, inductive, active, and sequential. The learning style used in this study is that of David Kolb, who claims that a person's orientation in the learning process is influenced by four tendencies [36]. These are concrete experiences (feelings), introspective observations (observations), abstract

conceptualizations (thinking), and active experimentation (behaviour). The four learning tendencies, when combined, will form four types of learning styles as follows: (1) diverger, which is a combination of elements of concrete Experience and reflective observation, (2) assimilator, namely a combination of abstract Conceptualization and reflective observation, (3) converger, namely a combination of abstract Conceptualization and active experimentation, (4) accommodator, which is a combination of elements of concrete Experience and active experimentation. Kolb's learning style is a learning style that facilitates students in facilitating the learning process [31].

Several studies [14], [37], [38] have been conducted about students' critical thinking in solving mathematical problems. In addition, a study [39] regarding mathematical problem-solving ability in Kolb's learning style. However, according to David Kolb, there is limited research linking critical thinking to solving math problems in the form of language problems or learning styles. It aims to describe students' critical thinking skills in solving word problems based on their learning styles.

2. METHOD

This type of research is qualitative descriptive research. This research was conducted in a school in Bantul, with the research subjects being 67 students of class XI MIPA 1 & 2 with a purposive sampling technique. The research instrument used in data collection was the Kolb Learning Styles Inventory (KLSI) learning style questionnaire which contained 40 statements, questions, and answers, tests of critical thinking skills on the material of sequences and series, and interviews tailored to Facione's critical thinking indicators. The KLSI learning style questionnaire used was adapted from Melinda [40]. The following are critical thinking skills test questions in this study.

1. Prita will distribute the money to her five younger siblings. These divisions form an arithmetic sequence. It is known that the amount of money given to the first, second, and third siblings is IDR. 81,000.00. Meanwhile, the amount of money given to the fourth and fifth siblings was IDR. 96,000.00. Determine the total amount of Prita's money to be distributed among her five sisters!
2. The human digestive tract has a bacterium called Escherichia coli (E. coli). E. coli bacteria reproduce by dividing into two every 20 minutes. If there are 25 E. coli bacteria initially, how many E. coli bacteria are there in 3 hours?
3. Mr Agus opened a tempe chips snack business with an initial capital of IDR. 300,000.00. Pak Agus already has 360 packages of tempeh chips from this capital ready to sell. On the first day, Mr Agus' snacks sold eight packages for IDR. 24,000.00. Then on the second day, 12 packs were sold for IDR. 36,000.00, and on the following days, four more packages were sold. How much profit does Mr Agus get when the stock of tempeh chips snacks runs out?
4. Zahra bought a ribbon to decorate a gift. Arriving at the house, Zahra cut the ribbon into six parts that form a geometric sequence. The tape with the shortest part has a size of 12 cm, while the most extended has a size of 384 cm. If the price of 1 m ribbon is IDR. 1,000.00, how much money must Zahra pay?

Figure 1. Critical Thinking Test

The data analysis technique in this study is Miles and Huberman's model consisting of data condensation, data presentation, and conclusion [41]. At the data condensation stage, the researcher calculated the learning style aspects of each student in the completed KLSI questionnaire. The researcher also corrected the students' test answers to measure

their critical thinking skills. At this stage, the KLSI learning style questionnaire results were categorized into learning styles according to David Kolb: diverger, assimilator, converger, and accommodator. In this research, the learning style used is the learning style according to David Kolb, which states that a person's orientation in the learning process affects the tendency of empathy [36], namely Concrete Experience (feeling), Reflective Observation (watching), Abstract Conceptualization (thinking), and Active Experiment (doing). The four learning tendencies, when combined, will form four types of learning styles. This learning style is determined by calculating the most significant number of item combinations in the questionnaire [40], as seen in Table 1.

Table 1. Determination of Student Learning Style Kolb

Learning Style Type	Aspect
Diverger	Concrete Experience + Reflective Observation
Assimilator	Reflective Observation + Abstract Conceptualization
Converger	Abstract Conceptualization + Active Experiment
Accommodator	Active Experiment + Concrete Experience

The results of the critical thinking ability test are also categorized into three levels of critical thinking ability using each student's score with the provisions of the percentage of critical thinking ability in Table 2 [42].

Table 2. Percentage of Critical Thinking Ability

Score	Category
$0 \leq N \leq 60$	Low
$60 < N \leq 75$	Medium
$75 < N \leq 100$	High

The results of categorizing learning styles and critical thinking skills were combined, and subjects were interviewed. Next is the presentation of the data. The data obtained from interviews and student test answers were analyzed qualitatively with certain subjects and described as narrative texts, tables, graphs, and others. The last is the conclusion. At this stage, the results of data analysis are concluded to describe students' critical thinking skills in solving word problems based on David Kolb's learning style.

3. RESULTS AND DISCUSSION

In this study, students have three learning styles: diverger, assimilator, and converger, while students' critical thinking skills are high, medium, and low. Students' critical thinking ability in each learning style is different. Data on students' critical thinking skills based on David Kolb's learning style are presented in Table 3.

Table 3. The Result of Students' Critical Thinking Ability Based on David Kolb's Learning Style

Learning Style	Critical Thinking Level	Total Students
Diverger	High	-
	Medium	1
	Low	13
Assimilator	High	1
	Medium	4
	Low	34
Converger	High	-
	Medium	1
	Low	13
Total Students		67

The results of this study are based on the indicators of critical thinking proposed by Peter A. Facione: interpretation, analysis, evaluation, conclusion, explanation, and self-regulation.

3.1. Diverger learning style

Subjects with divergent learning styles have moderate DM and low critical thinking skills DL. In question 1, the DM subject fulfilled the analysis, evaluation, and inference indicators. Subject DM's answers are presented in Figure 2.

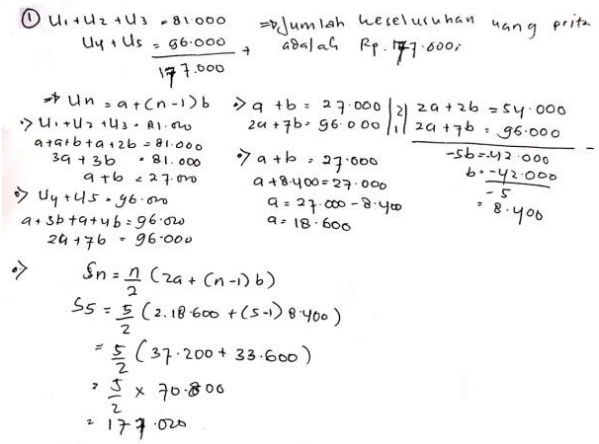

Figure 2. Answer subject DM number 1

Based on the responses above, the indicators of critical thinking mastered by DM subjects are the indicators of analysis, evaluation, and reasoning. However, DM subjects can also meet the interpretive index after the interview. The following excerpt from the interview demonstrates this.

Q : *Try to explain in your language what these questions mean!*
DM : *That means being asked to find the total amount of money Prita has distributed to her five younger siblings.*
Q : *Is the information in the question sufficient?*

DM : *Yes, ma'am, but if you want to find Prita's total money using the formula, it should not be enough.*
Q : *Can you mention what information is known in the question?*
DM : *There is money for the first, second, and third brothers. Then there is also the money for the fourth and fifth brothers.*

DM subjects solved numbers 2, 3, and 4 questions by fulfilling the interpretation, analysis, evaluation, and inference indicators. Furthermore, based on the interview results, it was found that the DM subject did not re-check the answers before being collected, and the subject felt less sure that the answer was correct. Thus, the DM subject does not have self-regulation. Based on the triangulation of test and interview answers, the critical thinking skills of DM subjects were at a moderate level. DM subjects fulfilled five critical thinking indicators and obtained correct answers for all four numbers. Thus, diverger students can master five indicators. This student can solve problems using arithmetic or geometric formulas (analysis).

On the other hand, some students with divergent learning styles have low critical thinking skills (DL). In question number 1, the subject of DL was able to complete it by fulfilling the indicators of interpretation, evaluation, and inference. However, after the interview, the subject could also meet the analysis and explanation indicators. In questions 2 and 3, the DL subject completed it by fulfilling the interpretation, analysis, evaluation, and inference indicators. However, the subject could also fulfil the explanation indicator after the interview. In question number 4, the DL subject solved the problem by fulfilling the analysis, evaluation, and inference indicators. However, after the interview, the subject was also able to meet the indicators of interpretation and explanation.

Furthermore, based on the interview results, the DL subject was known to re-check the answers before being collected, and the subject also felt sure that the answer was correct. Thus, the subject can be said to meet the self-indicator regulation. Based on the triangulation of student answers and interview results, the critical thinking skills of DL subjects were at a low level by fulfilling six critical thinking indicators, and the correct answers were obtained at numbers 1, 3, and 4. DL is wrong in the calculation of the indicator (evaluation). The results of critical thinking skills from other questions are presented in Table 4.

Table 4. Recap of Answers of Diverger Subjects

	Number 1		Number 2		Number 3		Number 4	
	DM	DL	DM	DL	DM	DL	DM	DL
Interpretation	-	√	√	√	√	√	√	-
Analysis	√	-	√	√	√	√	√	√
Evaluation	√	√	√	√	√	√	√	√
Inference	√	√	√	√	√	√	√	√
Explanation	-	-	-	-	-	-	-	-
Self Regulation	-	√	-	√	-	√	-	√

Students with divergent learning styles can master interpretation, analysis, evaluation, inference, and explanation indicators. However, some students have not been able to master the self-regulation indicators. Other research also states that students with divergent learning styles can write down facts and problems in questions, formulas, and concepts needed and can also write down the problem-solving process [43]. The divergent students can identify problems, analyze what is asked, and give the correct answer in something abstract and concrete [44]. Moderate divergent students (DM) at the time of solving the questions were unable to interpret or write down information that was known and asked in the questions, but at the time of the interview, the DM students were able to mention the information. Students who completed the questions admitted forgetting to write them down.

Divergent students cannot solve problems using formulas but use students' methods (analysis). Students with diverging learning styles can provide correct and complete alternative answers [45]. This is also in line with Gooden's research which states that people with this learning style want to generate various ideas and like to collect information. They have imaginative abilities that enhance creative situations and views from various points of view [46]. Low divergent students (DL) do not write down known and asked (interpretation) information in number 4, but students can mention it at the interview. Students recognize this as the reason students forget to write it down.

3.2. Assimilator learning style

Subjects with assimilative learning styles have high, medium, and low critical thinking skills—subjects with high assimilator learning styles (AH). For questions 1, 2, 3, and 4, the AH subject completed them by fulfilling the interpretation, analysis, evaluation, inference, and self-regulation indicators. However, after the interview, the subject of AH could also fulfil the explanation indicator. It is shown in the following interview excerpt.

Q : After you get the mathematical formula, can you solve the problem you have determined so that the result is obtained?
AH : Yes.
Q : Can you solve the problem in another way?
AH : No.
Q : Can you conclude the solution?
AH : Yes, ma'am, the conclusion is that the amount Zahra has to pay is IDR 7,560.00.
Q : What elements do you use to conclude?
AH : The element is the number of ribbon lengths Zahra bought multiplied by the known price per tape meter.

Furthermore, based on the interview results, the AH subject was known to re-check the answers before being collected, and the subject felt sure that the answer was correct. Thus, it can be concluded that the subject of AH meets the self-regulation indicators. Based on the triangulation of student answers and interviews, the critical thinking skills of AH subjects were at a high level by fulfilling six critical thinking indicators, and the correct answers were obtained on all four numbers.

Subjects with assimilative learning styles have moderate critical thinking skills (AM). In question number 1, shown in Figure 3, AM subjects solved the questions by fulfilling the analysis and evaluation indicators.

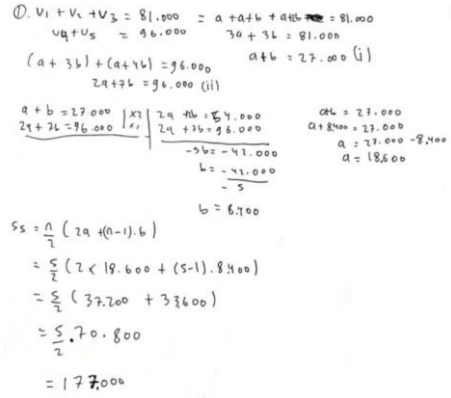

Figure 3. US subject answer number 1

Then after being confirmed by interview, the subject can also master the indicators of interpretation, inference, and explanation. For questions 2-4, AM subjects solved the questions by fulfilling the interpretation, analysis, and evaluation indicators. Furthermore, based on the interview results, the AM subject was known to have re-checked the answers before being collected, and the subject felt sure that the answer was correct. Thus, it can be concluded that the AM subject meets the self-regulation indicator. Based on the triangulation of test and interview answers, the critical thinking ability of AM was at a moderate level by fulfilling six critical thinking indicators, and correct answers were obtained at numbers 1, 3, and 4. because the subject was wrong in applying the concept of the formula (evaluation).

Assimilator students (AM), after question number 1, did not write down known and asked information (interpretation), but students were able to explain the information at the time of the interview. The students admitted this at the time of the interview as the reason students forgot to write it down. AM students also do not write conclusions on the test answer sheets but can explain their conclusions during the interview. Students recognize this because students are not accustomed to writing conclusions from the completion results.

On the other hand, some students with assimilator learning styles have low critical thinking skills (AL). In questions 1 and 4, AL subjects could complete them by fulfilling the interpretation, analysis, and evaluation indicators. However, after the interview, AL subjects could also meet the inference and explanation indicators. In question number 2, the subject can solve the problem by fulfilling the interpretation and evaluation indicators. However, after the interview, AL subjects could also fulfil the analysis, inference, and explanation indicators. For question number 3, the subject completed it by fulfilling the analysis and evaluation indicators. It is shown in Figure 4.

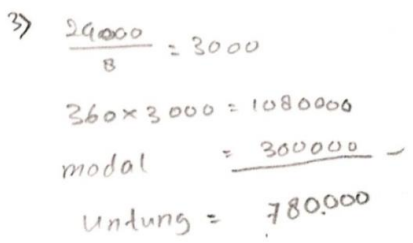

Figure 4. AL subject answer number 3

However, after the interview, the subject met the interpretation, inference, and explanation indicators. Furthermore, based on the results of the interviews, AL subjects were known to have not re-checked the answers before they were collected, and the subjects were not sure that the answers were correct. Thus, it can be concluded that the subject does not meet the self-regulation indicators. Based on the results of tests and interviews, AL subjects' critical thinking skills were low, with correct answers obtained at numbers 1, 3, and 4, and they could fulfil five critical thinking indicators. In answer to question number 2, the AL subject is not right in writing the final result because it is wrong in using the formula (analysis). The results of critical thinking skills from other questions are presented in Table 5.

Table 5. Recap of AH Subject Answers

	Number 1			Number 2			Number 3			Number 4		
	AH	AM	AL	AH	AM	AL	AH	AM	AL	AH	AM	AL
Interpretation	√	-	√	√	√	√	√	√	-	√	√	√
Analysis	√	√	√	√	√	-	√	√	√	√	√	√
Evaluation	√	√	√	√	√	√	√	√	√	√	√	√
Inference	√	-	-	√	-	-	√	-	-	√	-	-
Explanation	-	-	-	-	-	-	-	-	-	-	-	-
Self Regulation	√	√	-	√	√	-	√	√	-	√	√	-

Assimilator students solve problems in two ways, namely using arithmetic or geometric formulas and using their practical way. The majority of low assimilator students solve problem number 3 using a practical way because it is easier in their way and shortens the processing time. For questions number 1, 2, and 4, low assimilator students solve them by using arithmetic or geometric formulas. Low assimilator students (AL) do not write down the formula that will be used correctly (analysis), but students can mention the correct formula that should be used. Students recognize this because students do not remember the formula that should be used. AL students also did not write down known and asked information (interpretation) in number 3, but students could mention when the interview was conducted. The students acknowledged this because students forgot to write it down. In addition, AL students did not write down the conclusion of the solution (inference) on the four numbers, but students were able to explain it during the interview. Students recognize this because students are not accustomed to making or writing conclusions from solving mathematical problems.

Assimilator learning styles can solve problems using the appropriate formula for the problem and its way. The students with assimilator learning styles understand problem-

solving plans analytically, so it takes a long time to work on a thing [47]. However, some students have not been able to write conclusions from the results of solving problems. The assimilator students can describe problems, analyze what is asked in the questions, provide answers in the form of something abstract and concrete, and provide conclusions according to the language of the questions [44]. High and medium assimilator students can solve the four problems using arithmetic and geometric formulas correctly and coherently, from writing down the information on the problem to writing the conclusion of solving the problem. The assimilator students can solve problems with detailed and precise steps [48]. The assimilator students can describe problems, analyze what is asked of questions, provide answers in the form of something abstract and concrete, and provide conclusions according to the language of the questions [44]. On the other hand, low assimilator students solve problems in two ways: using arithmetic or geometric formulas and using their practical way. The students with assimilator learning styles understand problem-solving plans analytically, so it takes a long time to work on a thing [47].

3.3. *Converger* learning styles

Converger's learning style has moderate and low critical thinking skills. Subjects with moderate converger learning styles (CM). For questions 1, 2, 3, and 4, CM subjects could meet the interpretation, analysis, and evaluation indicators. One of the students' answers is presented in Figure 5.

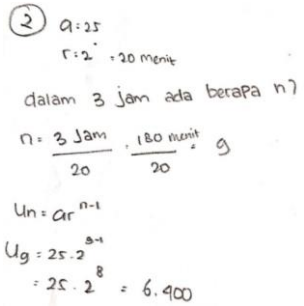

Figure 5. Answer CM subject number 2

Based on the answers above, the critical thinking indicators mastered by CM subjects are the indicators of interpretation, analysis, and evaluation. However, after the interview, the CM subject met the inference and explanation indicators. It is shown in the following interview excerpt.

Q : What formula did you use to solve this problem?
CM : Formulas $U_n = a.r^{n-1}$.
Q : After you get the mathematical formula, can you solve the problem you have determined so that the result is obtained?
CM : Yes.
Q : After you get the results that the questions asked for, try to conclude the results of your calculations!
CM : In conclusion, there is IDL. 6,400.00 bacteria in 3 hours.
Q : What elements did you use to draw that conclusion? Tell!
CM : The elements from the calculation results in U_9*, IDL. 6,400.00.*

Furthermore, based on the interview results, the CM subject is known to re-check the answers before being collected, and the subject feels sure that the answer is correct. Thus, it can be concluded that the CM subject meets the self-regulation indicator. Based on the results of tests and interviews, the critical thinking skills of CM subjects were at a moderate level, with correct answers on all four numbers, and they could fulfil six critical thinking indicators. The CM subject interpretation indicator is not maximized because the subject only writes known information. The information asked is not written down.

On the other hand, some students with converger learning styles have low critical thinking skills (CL). In questions 1 and 3, the CL subject completed it by fulfilling the interpretation and evaluation indicators. However, the CL subject could also fulfil the interview's analysis, inference, and explanation. Indicators For questions 2 and 4, the CL subject could complete them by fulfilling the indicators of interpretation, analysis, and evaluation. However, after the interview, the CL subject could also fulfil the inference and explanation indicators.

Furthermore, based on the interview results, the CL subject is known to have not re-checked the answers before being collected. However, the subject felt sure that the answer was correct. Thus, it can be concluded that the subject of CL does not meet the self-regulation indicators. Based on the triangulation of test answers and interviews, the critical thinking skills of CL subjects were at a low level, with correct answers obtained at numbers 1, 3, and 4, and they were able to meet five critical thinking indicators. In question number 2, the CL subject was not right in writing the final result because he was wrong in applying the concept of the formula used (evaluation). The results of critical thinking skills from other questions are presented in Table 6.

Table 6. Recap of Converger Subject Answers

	Number 1		Number 2		Number 3		Number 4	
	CM	CR	CM	CR	CM	CR	CM	CR
Interpretation	√	√	√	√	√	√	√	√
Analysis	√	-	√	√	√	-	√	√
Evaluation	√	√	√	√	√	√	√	√
Inference	-	-	-	-	-	-	-	-
Explanation	-	-	-	-	-	-	-	-
Self Regulation	√	-	√	-	√	-	√	-

Converger students could not write conclusions (interpretation) on the four numbers. However, students were able to explain their conclusions during interviews. Students recognize this because students are not familiar with writing conclusions from the results of problem-solving. Low converger students (CL) are not optimal in using strategies or formulas (analysis) in numbers 1 to 3. However, when interviewing, students can explain the strategies or formulas used correctly. Students recognize this

Converger learning style can write down information that is known and asked in the question (interpretation). However, some students cannot write conclusions from solving problems. The converger students can conclude the problems in the questions [43].

However, it is contrary to research from Hakima state that critical-thinking students with converging learning styles can make appropriate conclusions [45], and Firdausi that students with a converger learning style can solve problems well, conceptually, sequentially, and systematically [46].

4. CONCLUSION

Only three learning styles are produced in this study: diverger, assimilator, and converger. Students with divergent learning styles have moderate and low critical thinking skills. In this case, the divergent students could fulfil the five critical thinking indicators, and the correct test answers were obtained on the four numbers. The low divergent students, on average, were able to fulfil the five critical thinking indicators and got wrong answers on several numbers. Students with assimilator learning styles have high, medium, and low critical thinking skills. High assimilator students can fulfil all critical thinking indicators and get the correct test answers on all four numbers. Moderate assimilator students were able to fulfil all critical thinking indicators. Students with converger learning styles had moderate and low critical thinking skills. Convergent students can fulfil all critical thinking indicators and get the correct answers on all four numbers. The low converger students, on average, were able to fulfil the five critical thinking indicators.

ACKNOWLEDGEMENTS

The author would like to thank all parties, especially the lecturer of mathematics education at the UIN Sunan Kalijaga Yogyakarta, who have helped this research is completed.

REFERENCES

[1] Sutarji, "Analisis Kemampuan Berfikir Kritis Siswa Kelas VIII MTS Al-Washliyah Kolam dalam Penyelesaian Masalah Matematika Ditinjau Berdasarkan Perbedaan Jenis Kelamin," Universitas Islam Negeri Sumatera Utara, 2018.

[2] Z. Linda and I. Lestari, *Berpikir Kritis Dalam Konteks Pembelajaran*. Bogor: Erzatama Karya Abadi, 2019.

[3] I. Anugraheni, "Analisis Kemampuan Berpikir Kritis Mahasiswa Dalam Menyelesaikan Permasalahan Bilangan Bulat Berbasis Media Realistik," *Sch. J. Pendidik. Dan Kebud.*, vol. 9, no. 3, pp. 276–283, 2019.

[4] E. Y. Asmawati, "Lembar Kerja Siswa (LKS) Menggunakan Model Guided Inquiry untuk Meningkatkan Keterampilan Berpikir Kritis dan Penguasaan Konsep Siswa," *J. Pendidik. Fis.*, vol. 3, no. 1, Mar. 2015, doi: 10.24127/jpf.v3i1.13.

[5] S. Shanta, "T/E design based learning: assessing student critical thinking and problem solving abilities," *Int. J. Technol. Des. Educ.*, vol. 32, no. 1, pp. 267–285, 2022, doi: 10.1007/s10798-020-09608-8.

[6] C. Hikayat, "Design of realistic mathematics education approach to improve critical thinking skills," *Univers. J. Educ. Res.*, vol. 8, no. 6, pp. 2232–2244, 2020, doi: 10.13189/ujer.2020.080606.

[7] R. Ramadhani, "Students' critical mathematical thinking abilities through flip-problem based learning model based on LMS-google classroom," *Journal of Physics: Conference Series*, vol. 1657, no. 1. 2020, doi: 10.1088/1742-6596/1657/1/012025.

[8] N. R. Aini, "Problem-Based Learning for Critical Thinking Skills in Mathematics," *Journal of Physics: Conference Series*, vol. 1155, no. 1. 2019, doi: 10.1088/1742-6596/1155/1/012026.

[9] K. Ülger, "The relationship between creative thinking and critical thinking skills of students," *Hacettepe Egit. Derg.*, vol. 31, no. 4, pp. 695–710, 2016, doi: 10.16986/HUJE.2016018493.

[10] H. Purbonugroho, T. Wibowo, and H. Kurniawan, "Analisis Berpikir Kritis Siswa dalam Menyelesaikan Masalah Open Ended Matematika," *Maju*, vol. 7, no. 2, 2020.

[11] P. A. Facione, *Critical Thinking: What It is and Why it Counts*. Hermosa Beach: Measured Reasons

LLC, 2020.
[12] R. F. Liana, "Analisis kemampuan berpikir kritis siswa penyandang autis jenjang SDLB pada pembelajaran matematika di SLB Negeri metro," UIN Raden Intan Lampung, Lampung, 2017.
[13] F. Pujiasih, "Profil Kemampuan Berpikir Kritis Matematis Siswa Dalam Pemecahan Masalah Soal SPLDV Ditinjau dari Kemampuan Matematika," *J. Karya Pendidik. Mat.*, vol. 5, no. 2, pp. 9–19, 2018, doi: 10.26714/jkpm.5.2.2018.9-19.
[14] R. Maharani, R. Rasiman, and N. D. Rahmawati, "Analisis Berpikir Kritis Siswa SMP dalam Menyelesaikan Soal Matematika Bentuk Cerita," *Imajiner J. Mat. dan Pendidik. Mat.*, vol. 1, no. 4, pp. 67–71, 2019, doi: 10.26877/imajiner.v1i4.3883.
[15] F. N. Hidayah, W. Kusumaningsih, and D. Prasetyowati, "Analisis Kemampuan Berpikir Kritis Siswa SMA dalam Menyelesaikan Soal Cerita Ditinjau dari Gaya Belajar," *Imajiner J. Mat. dan Pendidik. Mat.*, vol. 2, no. 5, pp. 329–338, 2020, doi: 10.26877/imajiner.v2i5.6477.
[16] M. Azizah, J. Sulianto, and N. Cintang, "Analysis of Critical Thinking Skills of Elementary School Students in Learning Mathematics Curriculum 2013," *J. Penelit. Pendidik.*, vol. 35, no. 1, pp. 61–70, 2018.
[17] A. Fatmawati, S. Zubaidah, S. Mahanal, and Sutopo, "Critical Thinking, Creative Thinking, and Learning Achievement: How They are Related," *J. Phys. Conf. Ser.*, vol. 1417, p. 012070, Dec. 2019, doi: 10.1088/1742-6596/1417/1/012070.
[18] W. S. Kuswana, *Taksonomi Berpikir*. Bandung: Remaja Rosdakarya, 2013.
[19] N. Murniati, "Hasil Belajar Kognitif dan Berpikir Kritis Siswa Menggunakan Model Pembelajaraan Kooperatif Tipe Think Pair Share (TPS) di MAN 2 Kota Bengkulu," *Diklabio J. Pendidik. dan Pembelajaran Biol.*, vol. 4, no. 1, pp. 94–105, May 2020, doi: 10.33369/diklabio.4.1.94-105.
[20] A. Fridanianti, H. Purwati, and Y. H. Murtianto, "Analysis of Critical Thinking Ability in Solving Algebra Problems, Class VII SMP N 2 Pangkah Viewed from Reflective Cognitive Style and Impulsive Cognitive," *AKSIOMA J. Mat. dan Pendidik. Mat.*, vol. 9, no. 1, pp. 11–20, 2018, doi: 10.26877/aks.v9i1.2221.
[21] E. B. Johnson, *Contextual Teaching and Learning: Menjadikan Kegiatan Belajar Mengajar Mengasyikkan dan Bermakna*. Bandung: Mizan Learning Center, 2007.
[22] D. Pritananda, Rizka, "Kemampuan Berpikir Kritis Siswa pada Aspek Inference dalam Menyelesaikan Soal Cerita Teorema Pythagoras," *J. Pendidik. dan Pembelajaran Kahtulistiwa*, vol. 6, no. 9, pp. 1–8, 2017, doi: 10.26418/jppk.v6i9.21708.
[23] A. Priyanto, Suharto, and D. Trapsilasiwi, "Analisis Kesalahan Siswa dalam Menyelesaikan Soal Cerita Matematika Pokok Bahasan Teorema Pythagoras Berdasarkan Kategori Kesalahan Newman di Kelas VIII A SMP Negeri 10 Jember," Universitas jember, 2015.
[24] W. Wahyuddin and M. Ihsan, "Analisis kemampuan menyelesaikan soal cerita matematika ditinjau dari kemampuan verbal pada siswa kelas VII SMP Muhammadiyah se-Kota Makassar.," *Suska J. Math. Educ.*, vol. 2, no. 2, pp. 111–116, 2016, doi: 10.24014/sjme.v2i2.2213.
[25] R. S. Imtinan, "Analisis kemampuan verbal siswa dalam menyelesaikan soal cerita pada materi program linier," Universitas Muhammadiyah Malang, Malang, 2018.
[26] W. Wahyuddin, "Analisis Kemampuan Menyelesaikan Soal Cerita Matematika Ditinjau dari Kemampuan Verbal," *Beta J. Tadris Mat.*, vol. 9, no. 2, p. 148, 2017, doi: 10.20414/betajtm.v9i2.9.
[27] R. Febriyanti and Masriyah, "Profil Pemecahan Masalah Matematika Siswa Dalam Menyelesaikan Soal cerita Ditinjau dari Perbedaan Jenis Kelamin," *J. Ilm. Pendidik. Mat.*, vol. 2, no. 5, pp. 21–29, 2016, doi: 10.26740/mathedunesa.v5n2.p%25p.
[28] D. Rahmawati and L. D. Permata, "Analisis kesalahan siswa dalam menyelesaikan soal cerita program linear dengan prosedur Newman," *J. Pembelajaran Mat.*, vol. 5, no. 2, pp. 173–185, 2018.
[29] R. Kartikasari, "Analisis Kesulitan Siswa Dalam Menyelesaikan Soal Cerita Matematika Pada Siswa SMP," Universitas Muhammadiyah Surakarta, Surakarta, 2017.
[30] S. Rahmatillah and E. Oktavianingtyas, "Tingkat Kemampuan Berpikir Kritis Siswa dalam Menyelesaikan Soal Barisan dan Deret Aritmatika di SMAN 5 Jember," *Kadikma*, vol. 8, no. 2, pp. 51–60, 2017.
[31] E. Suwi, R. P. Situmorang, and S. P. Hastuti, "Hubungan Antara Gaya Belajar Model Kolb Dan Hasil Belajar Siswa Sekolah Menengah Pertama," *Edudikara J. Pendidik. dan Pembelajaran*, vol. 3, no. 1, pp. 51–61, 2018, doi: 10.32585/edudikara.v3i1.78.
[32] E. P. Azrai, E. Ernawati, and G. Sulistianingrum, "Ragam Gaya Belajar Siswa SMA Menurut David Kolb dalam Pembelajaran Biologi," *J. Al-AZHAR Indones. SERI Hum.*, vol. 4, no. 4, p. 251, 2018, doi: 10.36722/sh.v4i4.302.
[33] D. S. Setiana and R. Y. Purwoko, "Analisis kemampuan berpikir kritis ditinjau dari gaya belajar matematika siswa," *J. Ris. Pendidik. Mat.*, vol. 7, no. 2, pp. 163–177, 2020, doi:

10.21831/jrpm.v7i2.34290.
[34] Nurbaeti, S. Suryanti, and I. D. Pursitasari, "Hubungan gaya belajar dengan keterampilan berpikir kritis dan kemampuan kognitif siswa pada mata pelajaran kimia di kelas x smkn 1 bungku tengah," *Mitra Sains*, vol. 3, no. 2, pp. 24–33, 2015.
[35] A. Ghofur, D. Nafisah, and N. Eryadini, "Gaya Belajar dan Implikasinya Terhadap Kemampuan Berfikir Kritis Mahasiswa," *J. An-Nafs Kaji. Penelit. Psikol.*, vol. 1, no. 2, pp. 166–184, 2016, doi: 10.33367/psi.v1i2.285.
[36] S. A. McLeod, "Kolb's Learning Styles and Experiential Learning Cycle." 2017.
[37] U. Hasanah, "Analisis Kemampuan Berpikir Kritis dalam Pemecahan Masalah Matematika Siswa Kelas VII MTs Negeri 6 Sleman," pp. 1–126, 2017.
[38] A. Rachmanto, "Proses berpikir kritis siswa dalam pemecahan masalah pola bilangan berdasarkan kerangka kerja Norris dan Ennis," UIN Sunan Ampel Surabaya, 2019.
[39] M. I. Rumasoreng and M. Mahayati, "Analisis Kemampuan Pemecahan Masalah Matematika Siswa Kelas XI IPS I Imogiri dengan Model Pembelajaran Missouri Mathematics Project (MMP) Berdasarkan Pendekatan gaya Belajar Kolb," *Aksioma*, vol. 8, no. 1, pp. 19–28, 2019, doi: 10.22487/aksioma.v8i1.200.
[40] G. M. Melinda, "Identifikasi Gaya Belajar Model Kolb Terhadap Peserta Didik MAN II Yogyakarta," *J. Pendidik. SAINS*, vol. 6, no. 1, p. 47, 2018, doi: 10.26714/jps.6.1.2018.47-55.
[41] B. M. Miles, M. A. Huberman, and J. Saldana, "Qualitative data analysis: a methods sourcebook third edition," *United States Am. SAGE Publ. Asia-Pacific Pte. Ltd.*, vol. 30, no. 25, p. 33, 2014.
[42] Masrurotullaily, Hobri, and Suharto, "Analisis Kemampuan Pemecahan Masalah Matematika Keuangan Berdasarkan Model Polya Siswa SMK Negeri 6 Jember," *Kadikma*, vol. 4, no. 2, pp. 129–138, 2013, doi: 10.19184/kdma.v4i2.1045.
[43] O. Rahmawati, "Kemampuan Berpikir Kritis Matematis Ditinjau Dari Gaya Belajar Dengan Metode Guided Discovery Pada Siswa Kelas VIII Smp Muhammadiyah 1 Surakarta Tahun Ajaran 2016/2017," Universitas Muhammadiyah Surakarta, 2017.
[44] A. Sholihah, B. S. Anggoro, and R. W. Y. Putra, "Kemampuan Berpikir Reflektif dan Kritis Matematis Peserta Didik SMK Berdasarkan Gaya Belajar," *JKPM (Jurnal Kaji. Pendidik. Mat.*, vol. 7, no. 1, p. 169, 2021, doi: 10.30998/jkpm.v7i1.11326.
[45] N. I. Hakima, "Analisis Kemampuan Berpikir Kritis Siswa Ditinjau Dari Gaya Belajar Tipe Kolb Pada Materi Bilangan Bulat.," *Delta J. Ilm. Pendidik. Mat.*, vol. 8, no. 1, p. 1, 2020, doi: 10.31941/delta.v8i1.886.
[46] I. Jepri, B. Sinaga, and H. Syahputra, "Analisis Kemampuan Berfikir Kratif Matematis dalam Pemecahan Masalah Matematika yang Ditinjau dari Gaya Belajar Pada Siswa Kelas VIII SMP," 2018. doi: 10.24114/paradikma.v11i3.22926.
[47] S. Banjarnahor, B. Sinaga, and E. Napitupulu, "Analysis of Problem Solving Ability in Applying Problem Based Learning Reviewed From the Learning Style," *J. Educ. Pract.*, vol. 8, no. 34, pp. 127–135, 2017.
[48] E. N. Afiyati, "Kemampuan Berpikir Kreatif Siswa Berdasarkan Gaya Belajar Pada Pembelajaran Creative Problem Solving Berbantuan Kartu Masalah," Universitas Negeri Semarang, 2018.

https://doi.org/10.58421/gehu.v2i4.70