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Critical Thinking Ability of Vocational Students in Solving Systems of Equations With Three Variables Story Problems: A Review Based on Learning Style

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ABSTRACT

This study aims to describe the critical thinking skills of vocational students in solving the story problem of the equation system with 3 variables in the context of auditory, visual, and kinesthetic learning styles. This type of research is descriptive qualitative. Subject selection was based on the results of the learning style questionnaire consisting of six students in class XI with details of two students for each learning style. The research data were collected through critical thinking skills tests and interviews. The results showed that students with visual, auditory, and kinesthetic learning styles had different critical thinking skills. Students with visual learning styles can fulfill the aspects of interpretation, analysis, evaluation, explanation, and self-regulation. The inference aspect cannot be fulfilled by visual students. Students with auditory learning styles can fulfill the aspects of interpretation, analysis, evaluation, and explanation. The aspects of inference and self-regulation have not been fulfilled by auditory students. Students with kinesthetic learning styles can fulfill the aspects of interpretation, analysis, and evaluation. The aspects of inference, explanation, and self-regulation have not been fulfilled by kinesthetic students. All students have the potential to improve critical thinking skills, one of which is that teachers can ask open questions or questions that raise students' awareness so that they can have a positive impact on critical thinking skills.

Keywords**:** *Critical Thinking; Learning Style; SPLTV.*

Kemampuan Berpikir Kritis Siswa SMK dalam Menyelesaikan Soal Cerita SPLTV: Tinjauan Berdasarkan Gaya Belajar

ABSTRAK

Penelitian ini bertujuan untuk mendeskripsikan keterampilan berpikir kritis siswa vokasional dalam menyelesaikan masalah cerita sistem persamaan dengan 3 variabel dalam

konteks gaya belajar auditori, visual, dan kinestetik. Jenis penelitian ini bersifat deskriptif kualitatif. Seleksi subjek dilakukan berdasarkan hasil kuesioner gaya belajar terdiri dari enam siswa kelas XI dengan rincian dua siswa untuk setiap gaya belajar. Data penelitian diambil melalui tes keterampilan berpikir kritis dan wawancara. Hasil penelitian menunjukkan bahwa siswa dengan gaya belajar visual, auditori, dan kinestetik memiliki keterampilan berpikir kritis yang berbeda. Siswa dengan gaya belajar visual mampu memenuhi aspek interpretasi, analisis, evaluasi, penjelasan, dan regulasi diri. Aspek inferensi belum dapat dipenuhi oleh siswa visual. Siswa dengan gaya belajar auditori mampu memenuhi aspek interpretasi, analisis, evaluasi, dan penjelasan. Aspek inferensi dan regulasi diri belum terpenuhi oleh siswa auditori. Siswa dengan gaya belajar kinestetik mampu memenuhi aspek interpretasi, analisis, dan evaluasi. Aspek inferensi, penjelasan, dan regulasi diri belum terpenuhi oleh siswa kinestetik. Semua siswa berpotensi untuk meningkatkan keterampilan berpikir kritis, salah satunya dengan guru dapat mengajukan pertanyaan terbuka atau pertanyaan yang membangkitkan kesadaran siswa sehingga dapat berdampak positif pada keterampilan berpikir kritis.

Kata Kunci**:** *Berpikir Kritis; Gaya Belajar; SPLTV.*

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1. Introduction

Critical thinking skills have an important role for students in solving math problems. Critical thinking ability is the ability that underlies a person in solving problems and making the right decisions (Hedges, 1996). Critical thinking is a complex process that involves various aspects, such as analysis, evaluation, argument, and inference (Khoiriyah and Hidayati, 2020). These aspects are interrelated and interact with each other in the critical thinking process Students can train their critical thinking skills by getting used to being actively involved in solving problems that require critical thinking skills (Suratno and Kurniati, 2017). Problem-solving is the core of mathematics because it requires critical thinking skills (Schoenfeld, 2016). The benefits if students can think critically reason about a problem and be able to face other more difficult problems and can be applied in education, especially in the learning process (Rahayu, et al., 2022). Critical thinking in this study consists of six aspects, namely interpretation, analysis, evaluation, inference, explanation, and self-regulation. One of the efforts that can be made by teachers to train students' critical thinking skills is by giving mathematical problems.

Every student has the habits to solve math problems. Learning habits in this case are activities that are carried out repeatedly in a person's learning process which becomes his routine (Mahmudah, et al., 2021). Learning style is the easiest way for someone to learn and how they understand a subject matter. Students will more easily understand the material presented by the teacher if they already know the learning style that suits them (Afnia *et al.*, 2021). The classification of learning styles that will be used in this study is visual, auditory, and kinesthetic learning styles (Husamah, et al., 2016).

Solving math story problems is one of the problem-solving activities to train students' critical thinking skills. Story problems illustrate the relationship between problems and daily life as well as provide experience for students to be able to solve math problems (Islamiah, 2022). One of the materials from mathematics subjects that are usually presented in the form of story

problems is SPLTV material found in class XI at the senior high school / vocational students level. Vocational students in their learning often carry out vocational practices related to SPLTV material. SPLTV problems are contextual problems that are often encountered by vocational students in practical learning at school. For example, the application of N, P, and K fertilizers to corn plants with different doses produces different production. In this case, students are required to be able to solve SPLTV problems. Based on the description above, critical thinking skills are needed for vocational students to solve SPLTV.

The results of research conducted by Azzahra & Pujiastuti showed that students' problem-solving skills in solving SPLTV material were still low (Azzahra and Pujiastuti, 2020). Furthermore, Ardianik also conducted relevant research and found that students of class X SMA Islam Parlaungan Sidoarjo with visual, auditory, and kinesthetic learning styles had a low level of mastery of material on SPLTV story problems (Ardianik, 2018). The study shows that there is a gap between students' problem-solving skills and the level of mastery of SPLTV material. In addition, previous research also shows that students' learning styles can affect the level of mastery of the material. Vocational students have different characteristics from high school students, including in terms of learning approaches and the application of subject matter (Sartika and Darmawan, 2020). Because no research specifically examines the problem-solving ability of SPLTV in vocational students, the researcher is interested in knowing the critical thinking ability of vocational students in solving SPLTV story problems in terms of learning styles.

2. Research Methods

This type of research is descriptive with a qualitative approach with subjects consisting of 6 vocational students of XI class in the 2021/2022 school year with details of 2 people with visual learning styles, 2 people with auditorial learning styles, and 2 people with kinesthetic learning styles. The two students selected from each learning style level have the highest score with a difference in scores that is not too far away. The data collection method in this study consists of two, namely pre-research data collection methods and research data collection methods. The method included in the pre-research data collection method is a learning style questionnaire. This research used a questionnaire adopted from research conducted by Ningsih, (2021). The number of research subjects to be taken from the results of the learning style questionnaire is at least 6 students with details of each type of learning style of at least 2 students.

Based on the results of the learning style questionnaire, data on student learning styles and students' mathematical critical thinking skills were obtained. Learning style questionnaires that were done by students after analysis obtained the results are 11 students with visual learning styles, 8 students with auditory learning styles, and 8 students with kinesthetic learning styles. From the grouping results, 2 subjects from each learning style were selected based on the highest score in the learning style questionnaire. The selected subjects are presented in Table 2.

Table 1. Learning Style Questionnaire Analysis Results

Learning Style	Score	Code
Visual	19	SV_1
	17	SV_2
Auditory	14	SA_1
	13	SA_2
Kinesthetic	15	SK_1
	14	SK_2

After obtaining the selected subjects as shown in Table 2, data collection was then carried out. Data collection was carried out using the written test method and the interview method. Before data collection is carried out, the validity test of each instrument to be used is first carried out. Validation was carried out on questionnaire instruments, written tests, and interview guidelines. Instrument validation was carried out by validators, namely two mathematics education lecturers. The written test given consists of two-story problems with SPLTV material. Here is one example of a problem given to the research subject: Andi is a retiree from a company. During his time as an employee of the company, Andi diligently saved so that the total savings collected by Andi to date amounted to Rp. 840,000,000, - Andi invested half of the total savings he had into 3 forms of investment, namely deposits with an interest rate of 5%, stocks with an interest rate of 7%, and mutual funds with an interest rate of 9%. The total annual income received by Andi from the three investments is Rp. 26,000,000, - and the income from the deposit investment is Rp. 2,000,000, - more than the total investment income of stocks and mutual funds. Determine the amount of capital for each investment!

After doing the written test, the researcher then conducted interviews with all subjects to obtain additional information or clarification of the subject's answers on the critical thinking written test results. In addition, the interview results were also used to explore data that could not be identified from the critical thinking written test answers. The interviews were recorded using a *voice recorder*, then the interview recordings were transcribed and labeled to facilitate the data analysis process. The type of interview used was semi-structured interview. Then the results of the written test and the interview were analyzed.

Data analysis in this study is divided into two, namely pre-research data analysis and research data analysis. Pre-research data analysis includes analyzing the validity of the instruments used and analyzing the learning style questionnaire. The validated instruments are critical thinking test questions and interview guidelines. Then the learning style questionnaire was analyzed to determine the type of learning style of students. Research data analysis includes analysis of critical thinking test results and analysis of interview data.

This study uses indicators of critical thinking skills according to Fithriyah, et al., (2016) which was developed from the components of critical thinking skills proposed by Facione, (2015). Indicators of critical thinking skills in this study are presented in Table 1.

Table 2. Aspects of Critical Thinking Ability

No.	Aspects of Critical Thinking	Indicator
1.	Interpretation	Write down what is known and asked from the problem correctly and precisely.
2.	Analysis	a. Use concepts that are appropriate for solving SPLTV problems. b. Write down the mathematical model of the given problem.
3.	Evaluation	Write the solution to the problem precisely and correctly and suspect other alternatives.
4.	Inference	Conclude the given problem
5.	Explanation	Write the final result correctly and precisely, and give reasons in the form of arguments correctly.
6.	Self-Regulation	Rechecking the results of problem-solving appropriately and correctly

Critical thinking test analysis includes data reduction, data presentation, and conclusion drawing. (Miles, et al., 2014). The results of the critical thinking test analysis were then matched

back with student answers during the interview to obtain valid data. In addition, researchers triangulated the results of critical thinking tests and interviews to conclude a narrative of the critical thinking skills of research subjects based on the learning style categories they have. The data validity test used in this research is to increase persistence. That is a data validity checking technique based on how high the degree of persistence of researchers in carrying out observation activities is by making careful and continuous observations about the data obtained. (Jailani, 2020). In this study, checking the correctness of the data obtained from the results of the work of the research subjects was carried out carefully and repeatedly. In this way, the certainty of the data and the sequence of events can be recorded definitively and systematically so that researchers can provide an accurate and systematic description of what is observed.

3. Results and Discussion

Based on the results of the data analysis, there are some similarities and differences in the process of critical thinking ability in each type of learning style. Similarities and differences in the critical thinking process in each subject can be seen in Table 3.

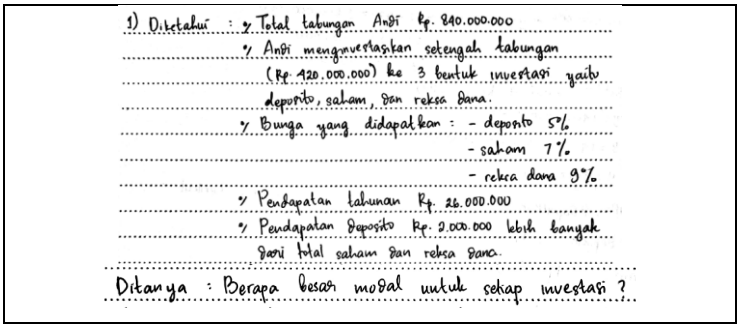
Table 3. The fulfillment of the aspects of the subject's critical thinking ability

Aspects of Critical Thinking Ability	Subject		
	Visual	**Auditory**	**Kinesthetic**
Interpretation	√	√	√
Analysis	√	√	√
Evaluation	√	√	√
Inference	×	×	×
Explanation	√	√	×
Self-Regulation	√	×	×

Description
√ : Fulfills critical thinking aspects
× : Does not fulfill critical thinking aspects

3.1 Critical Thinking Ability of Students with Visual Learning Style

In the interpretation aspect, visual learning style subjects can identify the information in the problem and can understand the meaning of the problem. This is shown in Figure 1 by writing the known and questionable information from the problem correctly and completely.



Picture 1. Visual Student Answers that contain Interpretation Aspects

P01 : *Was there any confusion in understanding the first question?*
SV_1 01 : *No*

P02 : *Can you clearly understand the meaning of question number 1 of the written test on the subject of SPLTV that you have done?*
SV_2 02 : *Yes, I understand sis.*
P03 : *How did you understand the problem in the first problem?*
SV_2 03 : *Reading repeatedly until I understand the meaning of the problem then I write down what is known and asked.*

In line with what was conveyed by Ahmadi and Supriyono, (2013) that students with visual learning styles will quickly learn materials that are presented in writing. Visual learning style subjects are also able to explain well through interviews about the information presented in the problem.

In the analysis aspect, visual subjects can use the appropriate SPLTV concept to make mathematical models from the information in the problem. This is indicated by the subject being able to make a mathematical model of the problem correctly and correctly. The steps used by visual subjects in making mathematical models are very complete and detailed. Related to this, it is explained by Mursari that students with a visual learning style are good planners and meticulous about details so that they can understand the structure contained in the problem (Mursari, 2019).

In the evaluation aspect, subjects with visual learning styles as a whole can write the solution to the problem presented properly and correctly. Subjects with visual learning styles in solving SPLTV story problems can use elimination, substitution, and combination methods. The steps and calculations used to solve the problem were written completely by the subject without missing anything. Students with a visual learning style type have the characteristics of being fast in reading and diligent, as well as good planners and can understand the information provided so that they can solve the problems given by the planned concept (Mursari, 2019).

In the inference aspect, the visual subject is overall able to write the conclusion of the problem. However, there are some conclusions written that are not in the context of the problem because the subject does not change the value of the variable obtained to what is sought according to the given problem. This happened because the subject was less careful in working on the problem. In line with the statement of Deporter and Hernacki, (2013) students with visual learning styles will lose concentration when they start to focus on problems which results in students making mistakes when working on problems. When given a question stimulus during the interview activity, the subject was able to self-reflect on the mistakes made and was able to complete the conclusion of the problem done on the written test.

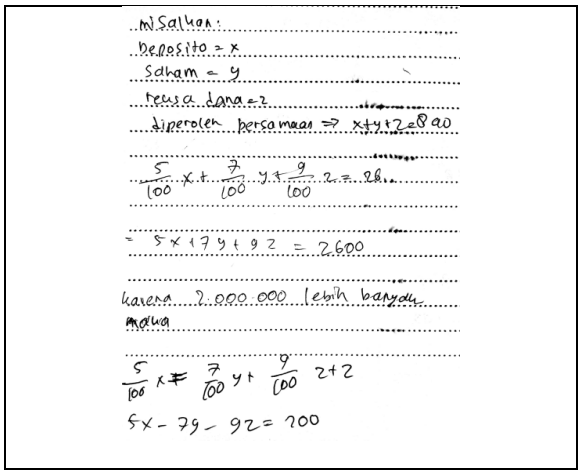
In the explanation aspect, subjects with visual learning styles can write the final results of the work done during the written test completely and correctly. In the interview activity, the subject can smoothly explain the reasons for the conclusions written during the written test. By Setiana & Purwoko that visual students can provide further reasons about the conclusion written down and can explain the terms contained in the problem (Setiana and Purwoko, 2020).

In the aspect of self-regulation, subjects with visual learning styles can write down the stages of solving the problem presented from beginning to end completely, although there are slight errors in calculations. Overall, students with visual learning styles write the stages from beginning to end. As for the interview activities that have been carried out, it shows that students with visual learning styles also re-sensitize the stages carried out during the written test in their way so that they are confident in the results of their work. In line with the opinion of Firdaus and Rustina that students with visual learning styles tend to be meticulous about small things so that they can identify problems and make general conclusions (Setiana and Purwoko, 2020).

3.2 Critical Thinking Ability of Students with Auditory Learning Style

In the interpretation aspect, auditory learning style subjects can identify information contained in the problem and can understand the meaning of the problem. In describing the information in the problem through interviews, subjects with auditory styles can explain in detail using their sentences. The results of the written test and interview showed that auditory students were able to write down what was known and asked from the problem properly.

In the analysis aspect, auditory learning style subjects can use the appropriate SPLTV concept and can correctly model the mathematics of the problem.



Picture 2. Auditory Students' Answers that contain Analysis Aspects

P12	:	*Is there a reason you're modeling deposits as x, stocks as y, and mutual funds as z?*
SA_1 12	:	*None*
P13	:	*Why should the symbol used be different?*
SA_1 13	:	*The symbols x, y, and z indicate the variables to be searched. Meanwhile, the problem to be sought is the investment capital of deposits, stocks, and mutual funds. Each value is of course different so the symbols are also different.*
P14	:	*What are the coefficients and constants of the problem?*
SA_1 14	:	*The coefficient is the interest rate, then the constant is the income generated, the initial capital.*

However, subjects with auditory learning styles only write down what they think is important and skip things they think can be skipped. This is in line with the opinion of Setiana and Purwoko that students with auditory learning styles tend to skip steps that they think can be skipped and only write things that they think are important because students with this type prefer to listen rather than write (Setiana and Purwoko, 2020).

In the evaluation aspect, subjects with auditory learning styles are overall able to write the solution of the problem presented properly and correctly. Some things are not written down by the subject in solving the problem, such as information from the equation that will be substituted or eliminated. Some calculations were also missed by subjects with auditory learning styles during the written test.

In the inference aspect, subjects with auditory learning styles are still less able to write conclusions by the context asked in the problem. Subjects with auditory learning styles in general have not been able to conclude well. There are many mistakes when writing conclusions, the mistake that often occurs is that the subject does not write the conclusion of the results

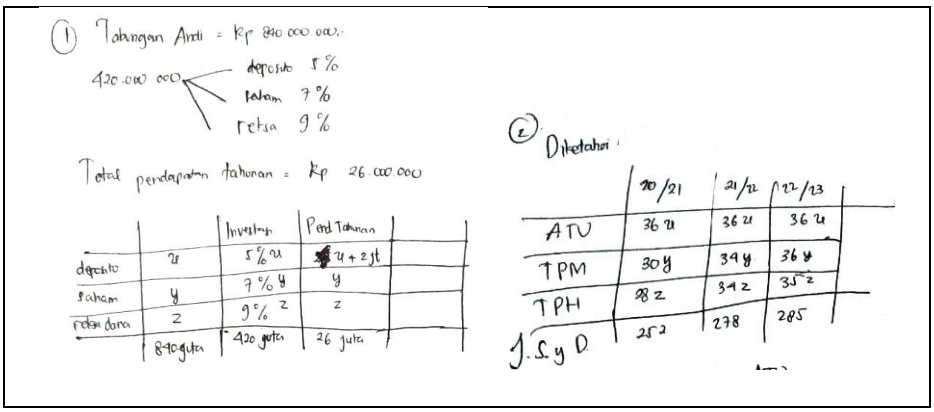
obtained by the questions given. The interview results showed that the subject seemed hesitant and had difficulty in making conclusions from what the question asked.

In the explanation aspect, subjects with auditory learning styles have not been able to write the solution to the problem because, in the inference aspect, the subject is unable to write the conclusion according to what the question asks. Then in the interview activity, the subject doubted the work that had been done during the written test. These doubts on average occur because the subject does not or has not written the conclusion according to what is asked from the question.

In the aspect of self-regulation, subjects with auditory learning styles can write down the steps in solving the problem properly. Some calculations and steps were missed, one of which was the conclusion. At the time of the interview, the subject with an auditory learning style had the belief that the steps done were correct without thoroughly examining the steps written from beginning to end.

3.3 Critical Thinking Ability of Students with Kinesthetic Learning Style

In the interpretation aspect, kinesthetic subjects can write down what is known and ask for the problem presented correctly and completely.



Picture 3. Kinesthetic Student Answers that contain Interpretation Aspects

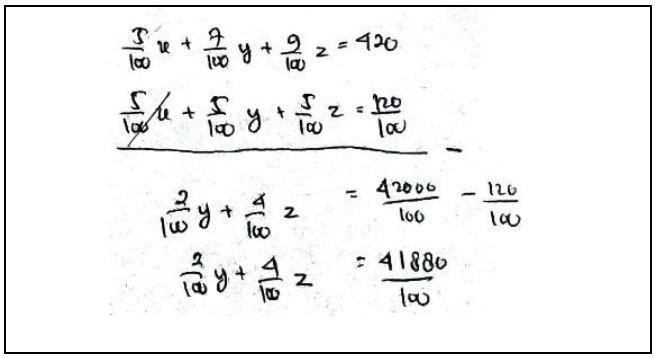
P10 : *Why did you use a table to write down what is known from the first problem?*
SK_1 10 : *Because it's easier for me to understand the problem and make the math model.*
P11 : *Then on the table, you write J.S.Y.D., what does that mean?*
SK_1 11 : *That's the number of students known as, I short JSYD.*

In contrast to visual and auditory subjects, subjects with kinesthetic learning styles have different ways of writing down the information known from the problem. Kinesthetic subjects used a table to write down the information known from the problem. In line with the opinion of Andayani and Amir that someone who has a kinesthetic learning style type tends to use exploration-based methods (Andayani and Amir, 2019).

In the analysis aspect, using concepts that are by solving SPLTV problems and making mathematical models of problems but not yet correct. There are subjects with kinesthetic learning styles who have difficulty in making mathematical models, especially in the first problem. This is because the subject has not understood the first problem. However, for the second problem, the subject can use the appropriate SPLTV concept and can create a mathematical model correctly. On the other hand, subjects with other kinesthetic learning styles

can smoothly use the SPLTV concept to make a mathematical model of the problem but it is less correct.

In the evaluation aspect, some subjects have not been able to write the solution to the first problem. The subject stopped after writing the elimination stage of the two equations obtained previously as shown in Figure 3.



Picture 4. Kinesthetic students' answers that contain evaluation aspects

P21 : *How did you solve problem number 1?*
SK_1 21 : *I planned to use the elimination method. However, there seems to be a wrong step that makes me stop at that stage.*
P22 : *What prevented you from solving the problem?*
SK_1 22 : *Because from the beginning, I didn't understand the problem, so I was confused.*
P23 : *Why did you use the elimination method to solve the first problem?*
SK_1 23 : *Because I find it easier to use the elimination and substitution methods.*

At the time of the interview, the subject already had a plan regarding the method to be used in solving the first problem, namely using the elimination method. However, the subject was unable to solve the first problem correctly due to the lack of student's ability to receive and use information from the problems presented (Aini and Siswono, 2014).

In the inference aspect, subjects with kinesthetic learning styles have not been able to conclude the questions given. Errors that are often made by subjects with kinesthetic learning styles are not writing conclusions from the results obtained by the context of the problem. In addition, errors in calculations also often occur resulting in incorrect final results. During the interview activity, the subject was also not able to conclude the answer even though it was guided by the researcher. Subjects with other kinesthetic learning styles do not write conclusions from the results of their problem-solving because, in the previous aspect, namely evaluation, the subject still does not fulfill.

In the explanation aspect, subjects with kinesthetic learning styles are unable to fulfill the inference aspect which causes the explanation aspect to also not be fulfilled. In this study, subjects with kinesthetic learning styles in writing the final results still had many mistakes. One of the mistakes made was inaccuracy when doing calculations which caused the final result to be wrong. In the results of in-depth interviews, subjects with kinesthetic learning styles were less able to explain the conclusions obtained during the written test. It can be seen from the answers to the interview activities that the subject is still not sure of the final results written down because many steps were missed.

In the aspect of self-regulation, subjects with kinesthetic learning styles write down the steps taken in solving problems in their way and tend to be different from visual and auditory subjects. However, the stages written down still have many mistakes. The prominent error is that subjects

with kinesthetic learning styles are less able to process the information obtained and implement the appropriate concepts to solve the problem. Another error that often occurs is inaccuracy in the calculation process which causes the results obtained to be less precise.

4. Conclusion

Based on the results and discussion above, an overall picture of students' critical thinking skills based on their learning styles is obtained. Each subject with a different learning style has its differences in solving SPLTV story problems which can be seen from the process carried out both through written tests and the results of interview activities. Visual students can fulfill the critical thinking aspects of interpretation, analysis, evaluation, explanation, and self-regulation, while the inference aspect is still not able to be fulfilled properly by visual students. Students with auditory learning styles in solving SPLTV story problems still do not fulfill the aspects of inference and self-regulation well. However, the critical thinking aspects of interpretation, analysis, evaluation, and explanation can be fulfilled by students with auditory learning styles. Students with kinesthetic learning styles in this study have not been able to fulfill the critical thinking aspects of inference, explanation, and self-regulation well. For future researchers, this research can be used as a reference to conduct relevant research using indicators of critical thinking skills that can be explored through both test and interview methods to maximize the analysis of students' critical thinking skills.

5. References

Afnia, S.N., et al. (2021). Analysis of Critical Thinking Ability in Solving Mathematics Problems Given Students' Learning Styles. *Jurnal Riset Pendidikan dan Inovasi Pembelajaran Matematika* ISSN, 4(2), 103-116.

Ahmadi, A., & Supriyono, W. (2013). Psychology of Learning. Rineka Cipta.

Aliseda, A. (2003). Mathematical Reasoning vs. Abductive Reasoning: A Structural Approach. Synthese, 134(1/2), 25–44. JSTOR. http://www.jstor.org/stable/20117324

Andayani, M., & Amir, Z. (2019). Building Students' Self-Confidence through Mathematics Learning. Decimal Journal of Mathematics, 2(2), 147-153. https://doi.org/10.24042/djm.v2i2.4279

Ardianik, B., Martono, & Setiawan, W. (2018). The Mastery Level of Class X Students of SMA Islam Perlaungan Sidoarjo in Solving Story Problems Based on Learning Styles. Surabaya.

Azzahra, R.H., & Pujiastuti, H. (2020). Analysis Of Student Problem-Solving Abilities On The Material Of Three Variable Linear Systems. *Transformasi: Jurnal Pendidikan Matematika dan Matematika*, 4(1), 153-162. https://doi.org/10.36526/tr.v4i1.876

Deporter, B., & Hernacki, M. (2013). Quantum Learning. Kaifa.

Facione, P.A. (2015). Advancing Thinking Worldwide.

Fithriyah, I., Sa'dijah, C., & Sisworo. (2016). Analysis of Critical Thinking Ability of Class IX-D Students of SMPN 17 Malang. March.

Hedges, L.E. (1996). Teaching for connection: Critical thinking skills, problem-solving, and academic and occupational competencies.

Husamah, & Pantiwati, Y. (2016). Learning and Learning (No. 8). UMM Press.

Islamiah, M.A.U., Trapsilasiwi, D., Oktavianingtyas, E., Kurniati, D., & Murtikusuma, R.P. (2022). Analysis of SPLTV Problem Solving Based on IDEAL Problem Solving Viewed from Visual-Auditorial-Kinesthetic (VAK) Learning Style. *Journal of Mathematics Education and Learning*, 2(1), 74. https://doi.org/10.19184/jomeal.v2i1.25589

Jailani, A. (2020). Data validity checking techniques: Researcher persistence test in qualitative research. *Jurnal Ilmiah Sosiologi dan Antropologi,* 12(1), 1-10.

Khoiriyah, S., & Hidayati, N. (2020). Developing students' critical thinking skills through problem-based learning. *Jurnal Pendidikan Islam Universitas Muhammadiyah Surakarta*, 11(2), 234-245.

Mahmudah, K., Pambudi, D.S., Oktavianingtyas, E., Lestari, N.D.S., & Murtikusuma, R.P. (2021). The Relationship Between Study Habits and Learning Motivation with Mathematics Learning Achievement of Junior High School Students During Online Learning. *KadikmA*, 12(2), 58. https://doi.org/10.19184/kdma.v12i2.26345

Miles, M.B., Huberman, A., & Saldana, J. (2014). Qualitative data analysis: a methods sourcebook (Vol. 0, No. 0). SAGE Publications.

Mursari, C. (2019). Description of Mathematical Critical Thinking Ability and Learning Independence of Students Based on Learning Style Introduction. *AlphaMath : Journal of Mathematics Education*. *5*(2):40. https://doi.org/10.30595/alphamath.v5i2.7345.

Ningsih, E.F. (2021). Creative Thinking Profile of SMP Class VIII Students in Solving Quadrilateral Problems given Learning Style. *KadikmA*, 12(1), 34. https://doi.org/10.19184/kdma.v12i1.22884

Rahayu, G., Kurniati, D., Jatmiko, D.D.H., Lestari, N.D.S., & Ambarwati, R. (2022). Analysis of Critical Thinking Ability of Junior High School Students in Solving Mathematical Problems of Algebraic Forms Material given Reflective and Impulsive Cognitive Styles. *Jurnal Edukasi dan Sains Matematika (JES-MAT)*, 8(2), 207-216. https://doi.org/10.25134/jes-mat.v8i2.6372

Sartika, D., & Darmawan, R. (2020). Differences in Learning Approaches and Application of Course Materials for Vocational and High School Students in Bandung City. *Jurnal Pendidikan Vokasi Universitas Pendikan Indonesia*, 8(2), 234-245.

Setiana, D.S., & Purwoko, R.Y. (2020). Analysis of critical thinking skills in terms of students' mathematics learning styles. *Jurnal Riset Pendidikan Matematika*, 7(2), 163-177. https://doi.org/10.21831/jrpm.v7i2.34290

Schoenfeld, A.H. (2016). Learning to Think Mathematically: Problem Solving, Metacognition, and Sense Making in Mathematics (Reprint). *Journal of Education*, 196(2), 1-38. https://doi.org/10.1177/002205741619600202

Suratno, S., & Kurniati, D. (2017). Implementation of performance assessment-based math-science learning model to improve students' critical thinking skills in the coffee plantation area of Jember. *Jurnal Pendidikan dan Evaluasi Pendidikan*, 21(1), 1-10. https://doi.org/10.21831/pep.v21i1.11799

Yuniarto, T. A. (2014). Analysis of Smp Students' Understanding in Solving Algebraic Problems on Pisa. MATHEdunesa, 3(2), 158-164.