Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang
Volume 8, No. 1, 2024, pp. 183 - 197
https://doi.org/10.31331/medivesveteran.v8i1.2739

Mathematics Critical Thinking Ability of Elementary School Students Viewed from Cognitive Style and Self-Efficacy

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***Received**: August 2023. **Accepted**: December 2023. **Published**: January 2024.*

ABSTRACT

This research aims to analyze students' mathematical critical thinking abilities based on cognitive style and self-efficacy. This research is qualitative descriptive research that uses classroom students as research subjects V in elementary schools in Gayungan District. A purposive sampling technique was used to analyze critical thinking skills and mathematics from 4 subjects in each field-dependent and field-independent cognitive style category with high and low self-efficacy. Instruments used in this research is a mathematical critical thinking ability test, self-efficacy questionnaire, and interview guide. The data analysis used is data reduction, categorization, and synthesis, as well as working hypotheses/conclusions. Conclusion From this research, field-dependent cognitive style students in the high self-efficacy category are better than field-dependent students low self-efficacy category. The results of the study obtained on the indicators of formulating and concluding students with cognitive styles field dependent only formulate and conclude if researchers ask about such indicators. SFD1 and SFD2 meet as young as indicators at level 2 and level 4, at level 1 SFD2 meets all indicators while SFD1 meets only the first indicator. At level 3 SFD1 meets all indicators while SFD2 meets only the first indicator, and at level 5 SFD1 meets only the first indicator while SFD2 empties the answer and cannot answer questions from researchers. Future researchers can further examine students' critical thinking abilities by reviewing other variables.
***Keywords**: cognitive style, mathematical critical thinking, self-efficacy.*

How to Cite: Yustitia, V., & Kusmaharti, D. (2024). Mathematics Critical Thinking Ability of Elementary School Students Based On Cognitive Style and Self-Efficacy. *Journal Of Medives : Journal Of Mathematics Education IKIP Veteran Semarang, 8*(1). 183 - 197.

INTRODUCTION

Critical thinking is one of the pillars 4K competencies, namely the ability to think critically, creatively, collaborate, and Communication is fundamental. Independent curriculum with one of its characteristics "a teaching and learning process that can encourage and inspire students to think critically, analytically and precisely identify, understand, solve problems, and apply material learning" is implemented in Indonesia as one efforts to prepare students to face the demands of the times increasingly competitive. Critical thinking is a vital component of 21st century skills so that a person is successful in work and life, according to the following framework.

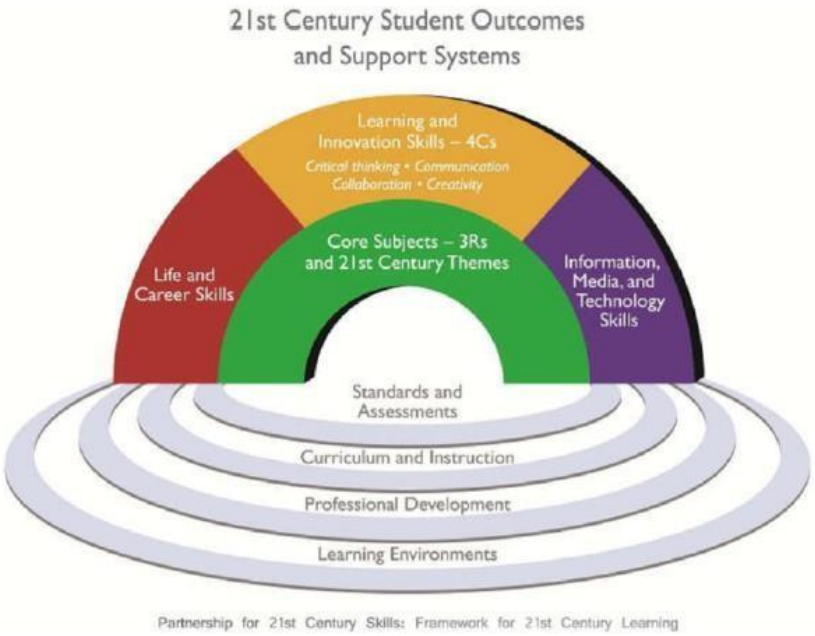

Figure 1. 21st Century Learning Framework

The framework shows that students are required to have life and career skills, learning and innovation, as well as the fields of information, media and technology. Critical thinking is one of the skills taught to students. Critical thinking is the ability to think reflectively and reason in making decisions (Ramos Salazar & Hayward, 2018). Critical thinking is important to have, helping someone make rational decisions in solving problems (Hafni, 2017; Spector & Ma, 2019; Ennis, 2018).

Mathematics learning does not only teach concepts, but requires students to develop critical thinking skills (Azizah et al., 2018). Critical thinking in mathematics learning is needed as a process in problem solving. The Merdeka Curriculum also facilitates teachers implementing learning oriented towards critical thinking skills.

One of the factors that influences critical thinking is cognitive style. Cognitive style is a form of cognitive activity (Silma et al., 2019). Cognitive styles differentiate individuals in interpreting, thinking, solving problems, learning, ability to relate, and making decisions (Elkaseh et. al., 2014; Ariawan & Zetriuslita, 2019; Wardhani & Wulandari, 2021). Cognitive style has an important role in the problem solving process. A person's cognitive style can be divided into two types, namely field independent and field dependent.

Someone with field dependent cognitive style is a person who global thinking, receiving structures or information existing, has a social orientation, chooses professions that are social skills, tend to be follow existing goals and information, and tend to prioritize external motivation, while people who have a field cognitive style independent is someone with characteristics able to analyze objects apart from environment, able to organize objects, has an impersonal orientation, chooses a profession that is individual, and prioritizes motivation from

in him.

Another factor that influences critical thinking skills is self-efficacy. Self-efficacy is the belief that students have in carrying out tasks ((Zimmerman, 2000; Arifin et al., 2021; Yustitia et al., 2021). Self-efficacy emphasizes an individual's self-confidence when facing future situations that are uncertain and unpredictable, and most of them are stressful (Öztürk et al., 2020). Self-efficacy is important for students because by having good self-efficacy, students are able to optimize and maximize their potential by feeling confident in their ability to achieve better academic achievements.

Several research results show the low critical thinking abilities of elementary school students in Indonesia (Aulia et al., 2019; Hapsari, 2016; Wardani & Yustitia, 2017; Suriati et al., 2021; Haeruman et al., 2017). The research results of Azizah, et al show that students' critical thinking abilities consist of a very critical category of 42.2%; critical 44.3%; quite critical 10.3%; and less critical 3% (Azizah et al., 2018). Ariawan & Zetriuslita (2019) stated that cognitive style influences critical thinking. Kozikoğlu stated that there is an influence of self-efficacy on students' critical thinking (Kozikoğlu, 2019). Hidayat & Noer explained that junior high school students with low self-efficacy have low mathematical critical thinking abilities, then conversely students with high self-efficacy have good critical thinking abilities in the learning process (Hidayat & Noer, 2021).

The results of interviews with several teachers at SDN Dukuh Menanggal I, SDN Gayungan II, and SDN Ketintang I showed that students' abilities in solving mathematical problems, especially in questions that train students' critical thinking, are still relatively low. When the teacher gives critical thinking questions, only a few students are able to solve them. This phenomenon is interesting for further research. Based on the presentation above, researchers are interested in exploring the critical thinking abilities of students with field dependent and field independent cognitive styles who have high and low self-efficacy.

METHOD

Researchers used qualitative methods with a phenomenological approach. The researcher's aim of using a phenomenological approach is to describe the phenomena experienced by students regarding critical thinking skills in terms of cognitive style and self-efficacy.

This research was carried out in elementary schools in Gayungan District. Subjects were selected from 14 elementary schools in Gayungan District. Through purposive sampling, several students were selected with certain cognitive styles and self-efficacy. Research subjects were selected based on the results of cognitive style and self-efficacy questionnaires as well as recommendations from teachers who know more about students' abilities and personalities in learning.

The test instrument is a critical thinking ability test, and the non-test instrument is a cognitive style questionnaire, self-efficacy questionnaire and interview guide. The test used in this research is a test in the form of a description of spatial building material that is valid and reliable. The questionnaire is in the form of a Group Embedded Figure Test (GEFT) cognitive style questionnaire. GEFT was developed by Witkin. GEFT is used to determine the differences between field dependent and field independent cognitive styles. The criteria used in selecting subjects used criteria according to Kepner and Neimark (Basir, 2015), namely subjects who could answer correctly $0 \leq FD \leq 9$ were classified as field dependent (FD) and $10 \leq FI \leq 18$ were classified as field independent (FI). This data was analyzed using the following criteria, research subjects who answered correctly

with a score of $0 \leq FD\ rendah \leq 4$ were classified as low FD, $5 \leq FD\ tinggi \leq 9$ were classified as high FD , $10 \leq FI\ rendah \leq 14$ is classified as low FI, and $15 \leq FI\ tinggi \leq 18$ is classified as high FI.

The Self-efficacy questionnaire was given with the aim of knowing students' level of Self-efficacy (high and low) and was adapted by May Diana. Next, students in that class were given a self-efficacy questionnaire, then the scores obtained by the students were converted and categorized into the high category based on the rules in Table 1 below.

Tabel 1. Category of Self Efficacy

Category *of Self Efficacy*	Category
High	Skor self efficacy $\geq \bar{X} + SD$
Medium	Skor self efficacy $> \bar{X} - SD$ and $< \bar{X} + S$
Low	Skor self efficacy $\leq \bar{X} + SD$

Data analysis techniques in this research include: 1) Data reduction, by taking data appropriate in the data analysis process. 2) Categorization and synthesis, reduced data adapted to the analytical needs of researchers, namely students' mathematical critical thinking abilities based on self-efficacy and gender. 3) Working hypothesis/conclusion, based on the results of data analysis will produce new findings in the form of a conceptual description of the research problem. Data validity is obtained by applying data triangulation, namely technical triangulation This was done by comparing written test and interview data.

RESULTS AND DISCUSSION

Based on the results of the GEFT test given to all student samples, obtained grouping cognitive styles of field dependent students (FD), field independent (FI), and Neutral like shown in Table 2 below:

Table 2. Distribution of Students' Cognitive Styles

Students taking the test	Cognitive Styles		
	FD	FI	Netral
102	39	38	25

The number of samples from 3 schools taking the GEFT test were 102 students. There were 6 students from the initial sample (108 students) who did not take the GEFT test. The test results show as many as 38 students who have the FI cognitive style, 39 FD cognitive style and 25 students do not have tendency for FI or FD cognitive style (Neutral). The distribution of cognitive styles is quite balanced, especially for FI and FD cognitive styles which are the focus in this research. From these results, the number of samples taken for research analysis are as many as 77 students (FI and cognitive style groups FD).

The categorization of self-efficacy is based on the tendency of students' scores at the self level efficacy. The categorization of self-efficacy is divided into three, namely high, medium and low self-efficacy. Table 3 shows the self-efficacy questionnaire, the results of

which are as follows.

Table 3. Distribution Of Students' self-efficacy

Students taking the test	Self-efficacy		
	High	Medium	Low
102	23	70	25

In Table 3, students with the modium self-efficacy category show the highest percentage Among other categories, namely high and low. In line with previous research shows that the number of students who have the highest self-efficacy are students with medium self-efficacy. High and low categories were applied by researchers as research subjects. In addition, researchers use recommendations from related subject teachers regarding appropriate subject study. So that in each category 2 students were selected, namely high and low level students, namely SFD1 and SFD2. SFD1 is a student with a field dependent cognitive style with high self-efficacy. SFD2 is a student with a field dependent cognitive style with low self-efficacy.

Mathematics Critical Thinking Ability Of Student With A Field Dependent Cognitive Style With High Self-Efficacy

The following are the results of the mathematical literacy answers measured in accordance with the students' mathematical literacy indicators with 5 questions.

1) Critical thinking ability Question Level 1

a) Identify information based on existing instructions

SFD1 can identify information based on existing instructions by explaining what is known from the question, namely 2 3/7 parts of Rini's cake, and explaining what is being asked, namely how many parts of the white box are shaded.

b) Perform calculations according to the strategy used

In this indicator SFD1 is able to answer the questions in number 1. However, SFD1 does not meet the indicators because SFD1's answer is not correct. This can be seen in Figure 1, namely the answer of SFD1 in answering question number 1.

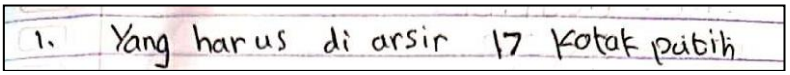

Figure 1. Answer SFD1 Question Number 1

SFD1 does not meet these indicators. SFD1 was able to answer the questions asked by the researcher, but SFD1's answer was not quite right.

2) Critical thinking ability Question Level 2

a) Gathering factual information from the existing context

SFD1 meets these indicators, it can be seen from the description of the interview with SFD1 as follows.

Based on the description of the interview with SFD1 it is known that SFD1 has met these indicators, because SFD1 can collect factual information from question number 2, namely by answering questions from researchers based on what is known from the question, the initial price of the pizza shop is 50,000 and "Kedai X" provides

a discount of 20 %, "Store Y" gives 15% + 5% discount.

b) Work on problems using basic algorithms and formulas in solving problems

SFD1 is able to meet these indicators, this can be seen from the results and process of student work on question number 2 in Figure 2 as follows.

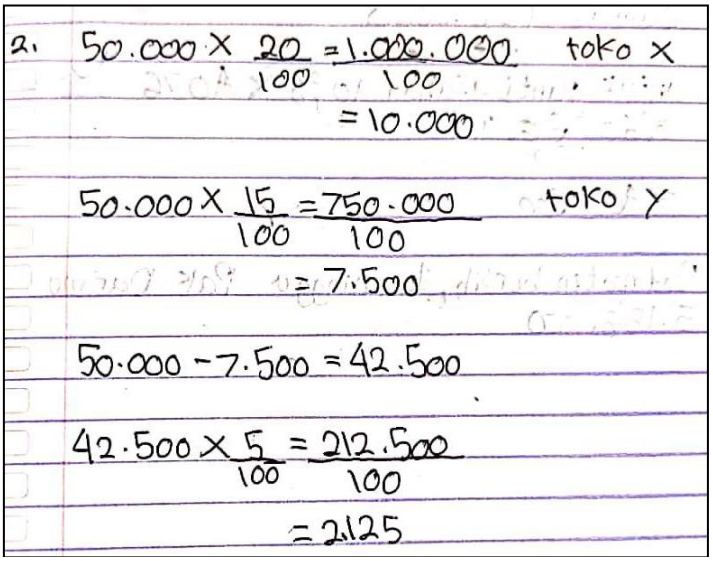

Figure 2. Answers SFD1 Question Number 2

c) Summarizing the results of the problem

SFD1 is able to conclude the results of the work from problem number 2, because SFD1 is able to solve existing problems and concludes that shop x has a cheaper price.

3) Critical thinking ability Problem Level 3

a) Using representations based on available information

SFD1 has fulfilled these indicators because SFD1 has correctly answered the questions posed by the researcher, namely Roni has 1 kg. Then it fell as much as 500 grams, and added in the refrigerator there were 2 1/3 kg and what was asked of the question was Roni's total flour.

b) Implement clear procedures in solving problems

SFD1 has met these indicators, it can be seen from the description of the answers attached in Figure 3 as follows.

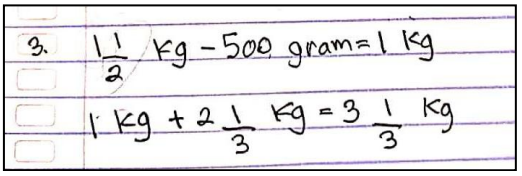

Figure 3 Answers SFD1 Question Number 3

SFD1 performs the procedure by subtracting the flour that Roni bought by subtracting the flour that fell and then adding it to the flour in the refrigerator.

c) Describe the results of the formulation of the problem you have

SFD1 has met these indicators, it

can be seen from the description of the correct answer, namely SFD1 concludes 3 1/3kg as the final answer.

4) Critical thinking ability Question Level 4

a) Using information in the given context

SFD1 has fulfilled these indicators, because SFD1 explained during the interview that Budi held the number 61%, Yuda 5/9, Dinda 0.7 and Ade 1 yang and what was asked of the question, SFD1 explained that who was behind Ade.

b) Working on problems with certain steps and methods that involve assumptions in context

SFD1 has met these indicators, it can be seen from the description of previous interviews with researchers. SFD1 converts known numbers into common fractions and then sorts them. SFD1 performs calculations by equating the denominator of the common fraction.

c) Provide conclusions and reasons based on the formulation they have

SFD1 has fulfilled these indicators, by concluding that the person behind Ade is Dinda

5) Critical thinking ability Question Level 5

a) Work with models in identifying problems from complex situations by establishing assumptions

SFD1 has fulfilled these indicators, by explaining what is known from the questions, namely that there are data on the sales of Mr. Darmo, Mr. Darmo's capital, and donations to the orphanage.

b) Using his thinking and reasoning in doing calculations

SFD1 does not meet these indicators, this is because SFD1 does not meet these indicators, this is because SFD1 is not able to solve the problems that exist in question number 5. This can be seen in the description of the answers in Figure 4 as follows.

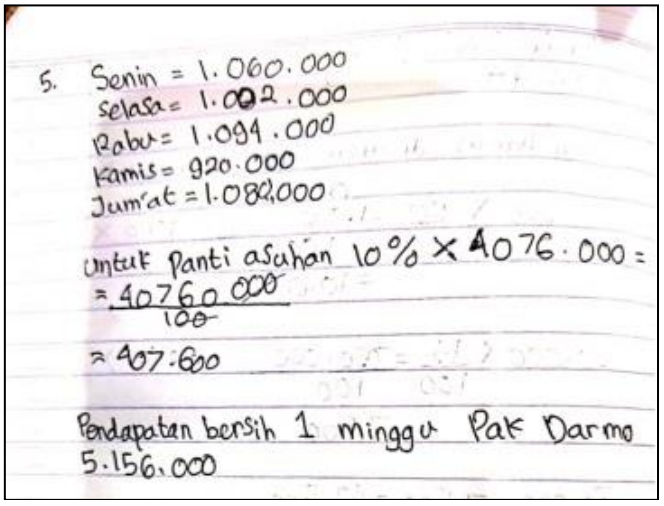

Figure 4. SFI2 Answers to Question Number 5

c) Describe the results of the formulation and the reasons

SFD1 cannot meet these indicators, because SFD1 is not able to solve the problems in question number 5.

The following are the results of the mathematical literacy answers measured in accordance with the students' mathematical literacy indicators with 5 questions.

1) Critical thinking ability Question Level 1

a) Identify information based on existing instructions

SFD2 can identify information based on the instructions in the questions. SFD2 explains what is known from the problem, namely Rini has 2 3/7 part of the cake and what is asked from the question is how many remaining parts must be shaded by Rini.

b) Perform calculations according to the strategy used

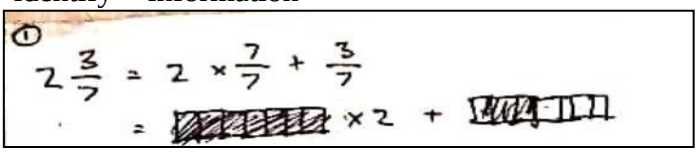

Figure 5. SFD2 Answers to Question Number 1

SFD2 to explain the answers that have been done by SFD2, namely by shading 2 full parts, each of which consists of 7 boxes, SFD2 explains that 1 part is the same as 7 parts of all shaded boxes. Based on the results of interview analysis with SFD2 based on the results of written tests and interviews with SFD2 already meet these indicators.

2) Critical thinking ability Question Level 2

a) Gathering factual information from the existing context

SFD2 has met these indicators, SFD2 explains what is known from the question, namely there is a 20% discount and a 15% + 5% discount and explains what is being asked from the question, namely the shop that has the cheapest final price.

b) Work on problems using basic algorithms and formulas in solving problems

SFD2 does not meet these indicators, this can be seen from the results and process of student work on question number 2 in Figure 6 as follows.

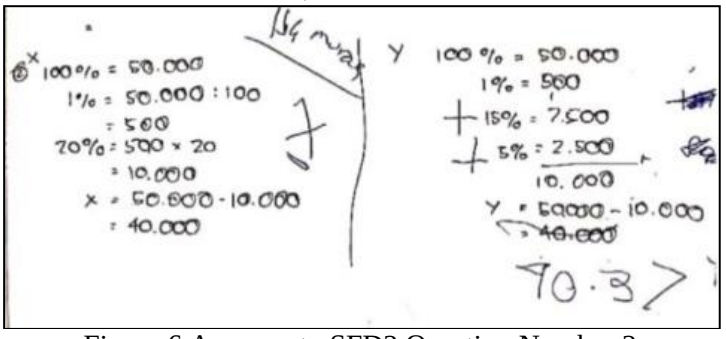

Figure 6 Answers to SFD2 Question Number 2

SFD2 does not meet these indicators because SFD2 describes an inappropriate strategy in solving problem number 2, it can be seen from the interview description as follows.

c) Summarizing the results of the problem

SFD2 does not meet these indicators because when SFD2 answers questions from researchers, SFD2 answers are not quite right. SFD2 concludes that the

answer is not quite right, because the correct answer is "Kedai X" which has a cheaper price of 40,000.

3) Critical thinking ability Problem Level 3

a) Using representations based on available information

SFD2 has met these indicators, because SFD2 is able to explain what is known when conducting interviews with researchers, namely there are 1 kg, 500 grams, and 2 1/3 kg and SFD2 explains what was asked from the question, namely Roni's total flour.

b) Implement clear procedures in solving problems

SFD2 does not meet these indicators, because SFD2 attaches an incorrect answer in Figure 7 as follows.

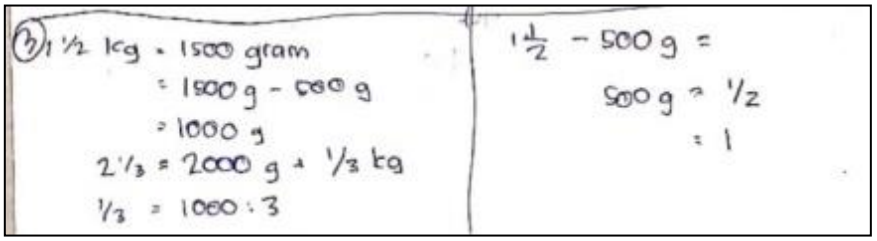

Figure 7 Answers to SFD2 Question Number 3

c) Describe the results of the formulation of the problem you have

SFD2 does not meet these indicators, this is because SFD2 is not able to solve the problem in question number 3, so SFD2 cannot describe the results of the formulation that is owned in solving the problem.

4) Critical thinking ability Question Level 4

a) Using information in the given context

SFD2 has met these indicators, this is because SFD2 is able to explain what is known from the questions, namely there are numbers 61%, 5/9, 0.7 and 1 belonging to Budi, Yuda, Dinda and Ade, and SFD2 explains what is being asked of the questions. that is the order after Ade.

b) Working on problems with certain steps and methods that involve assumptions in context

SFD2 has met these indicators, it can be seen from the description of the answers attached in Figure 8 as follows.

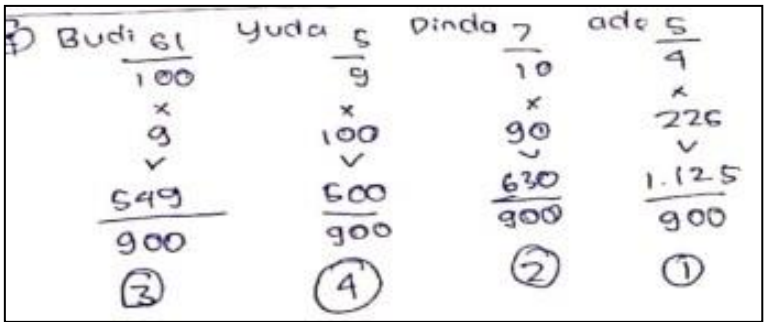

Figure 8 Answers to SFD2 Question Number 4

c) Provide conclusions and reasons based on the formulation they have

SFD2 has met these indicators, this is because SFD2 is able to solve the problems that exist in the question, namely the order after Ade is Dinda, SFD2 provides a sequence of numbers on the answer sheet.

5) Critical thinking ability Question Level 5

a) Work with models in identifying problems from complex situations by establishing assumptions

SFD2 cannot meet these indicators, this is because SDF2 cannot solve the problems in question number 5 and leave the answer number 5 blank on the worksheet.

b) Using his thinking and reasoning in doing calculations

SFD2 does not meet these indicators, this is because SFD2 is not able to solve the problems in question number 5. SFD2 also empties the time sheet for question number 5.

c) Describe the results of the formulation and the reasons

SFD2 cannot meet these indicators, because SFD2 is not able to solve the problems in question number 5. Based on the results of the analysis, it is found that SFD2 can meet all indicators at the lowest level, namely level 1 with two indicators, namely identifying information based on existing instructions and performing calculations according to the strategy used, while SFD1 only meets the first indicator.

SFD1 meets level 2 with three

indicators, namely collecting factual information from the existing context, and concluding the results of the problem, while SFD2 only meets the first indicator. SFD1 meets level 3 with three indicators, namely using representations based on available information, carrying out clear procedures in solving problems, and describing the results of the formulation while SFD2 only meets the first indicator, namely identifying information.

SFD1 and SFD2 are able to meet level 4 with three indicators, namely using information in the existing context, working on problems with certain steps and methods that involve assumptions and providing conclusions and reasons based on the formulation they have. SFD1 is at the highest level, namely level 5 with only one indicator that is fulfilled, namely identifying the problem, while SFD2 does not answer the question in question number 5 and leaves the answer to the question blank.

Students with field dependent cognitive style on indicators formulate and conclude that researchers must ask questions related to these indicators so that students can fulfill these indicators. In this study there are still some shortcomings so that the results of the analysis of critical thinking still seem shallow (Azizah et al., 2018). One of the drawbacks is that too few questions are used. So that in analyzing the researchers can only analyze the fulfillment of indicators based on one question only.

CONCLUSION

The results of the study obtained on the indicators of formulating and concluding students with cognitive styles field dependent only formulate and conclude if researchers ask about such indicators. SFD1 and SFD2 meet as young as indicators at level 2 and level 4, at level 1 SFD2 meets all indicators while SFD1 meets only the first indicator. At level 3 SFD1 meets all indicators while SFD2 meets only the first indicator, and at level 5 SFD1 meets only the first indicator while SFD2 empties the answer and cannot answer questions from researchers.

Teachers understand more about cognitive styles of students belonging to Field Dependent and Independent Fields in Learning Activities. Teacher encourage students to take more ownership self-efficacy in working on critical thinking questions. Elementary school students should be aware the importance of learning styles and self-efficacy without ignoring the importance of learning group. Schools have programs which was socialized to eye teachers lessons to facilitate teachers knowing cognitive styles and self-efficacy to improve students' critical thinking abilities.

ACKNOWLEDGEMENT

The authors would like to thank the Ministry of education, culture research and technology (Kemdikbudristek) for supporting this research funding through grant funding with main contract number 128/SP2H/PT/LL7/2023 and derivative 079.15/kontrak/LPPM/VI/2023. The authors would also like to thanks rector Universitas PGRI Adi Buana Surabaya and headmaster of SDN Dukuh Menanggal 1 and SDN Gayungan II of who has supported the implementation of this research.

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