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Students' Mathematical Critical Thinking Skills Reviewed from Cognitive Style

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Abstract*—This research aims to analyze ability critical mathematical students of VIII grade of SMP Negeri 4 Kendari which reviewed from the style cognitive. Subject is student of class VIII4 consisting of from each 1 student field dependent and field independent that in category weak and strong. Technique data collection used Group Embedded Figures Test (GEFT), Test Mathematical Critical Thinking Skills, and Interview. Checking validity of data used triangulation technique. The results of the study show that (1) Students style cognitive in Weak Independent Field capable fulfil indicator interpretation, analysis, evaluation, but No capable fulfil indicator inference. While student style cognitive in Field Independent Strong capable fulfil indicator interpretation, analysis, evaluation and inference; (2) Students style cognitive Weak Field Dependent capable fulfil indicator interpretation, less capable fulfilling the analysis and evaluation indicators, and not capable fulfil indicator inference. Students style cognitive in Strong Field Dependent capable fulfil indicator interpretation and analysis, less capable meet the evaluation indicators, and No capable fulfil indicator inference*.

***Keywords*—** *Mathematical thinking critical, style cognitive, field dependent and independent*.

I. INTRODUCTION

Education is a process that humans do to develop themselves as best as possible. According to Law No. 20 of 2003 (Ministry of National Education, 2003: 4) concerning the National Education System, national education aims to develop abilities and form a dignified character and civilization of the nation in order to educate the life of the nation. To achieve these educational goals, the government has created a learning curriculum, one of which is the mathematics learning curriculum

Learning mathematics is a very important subject, because in our daily lives we will not be separated from the use of mathematics, from simple to complex problems. Mathematics subjects need to be taught to all students starting from elementary school to equip them with logical, analytical, systematic, critical, and creative thinking skills, as well as the ability to collaborate (Ministry of National Education, 2006: 38). Students' mathematical knowledge is better if they are able to construct their previous knowledge with the new knowledge they gain. Therefore, active student involvement greatly influences the success of mathematics learning. In mathematics learning, teachers must be able to develop several aspects of students, including cognitive, affective, and creative aspects.

The Content Standards and Competency Standards for Gradeuates (Ministry of National Education, 2006: 346) state that the purpose of providing mathematics subjects is for students to have the ability to (1) Understand mathematical concepts, explain the relationship between concepts and apply concepts or logarithms flexibly, accurately, efficiently and precisely in problem solving, (2) Use reasoning on patterns and properties, carry out mathematical manipulations in making generalizations, compiling evidence, or explaining mathematical ideas and statements, (3) Solve problems which include the ability to understand problems, design mathematical models, complete models, and interpret the solutions obtained, (4) Communicate ideas with symbols, tables, diagrams, or other media to explain situations/problems, (5) Have the nature of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in mathematics lessons as well as a tenacious and confident attitude in problem solving. The first general objective, learning mathematics at the elementary and secondary education levels is to provide emphasis on skills in the application of mathematics, both in everyday life and in helping to learn other sciences.

Mathematics learning for students is the formation of mindset in understanding a concept or in reasoning about the relationship between those concepts. In mathematics learning, students are accustomed to gaining an understanding through experience about the properties they have and do not possessed from a set of objects (abstractions). Students are given experience using mathematics as a tool to understand or convey information, for example through equations, or tables in mathematical models that are simplifications of story problems or other mathematical descriptive problems. Mathematics learning will be meaningful if students can connect mathematical ideas, connect between mathematical topics, connect mathematics with other disciplines and connect mathematics with everyday life (Sugiarti, 2014: 151).

Students who have the ability to think critically, logically, systematically, and creatively are able to face life's challenges independently and with confidence. This thinking ability can be achieved through learning mathematics, which substantially encompasses the development of thinking based on logical, critical, systematic, and accurate reasoning principles. This thinking ability is generally known as mathematical thinking (Pramesti, 2014: 190).

Thinking is one of the mental activites that cannot be separated from human life. Thinking occurs in every human

Zamsir, Hartina Pratiwi La Mela, and Risman Alifin, "Students' Mathematical Critical Thinking Skills Reviewed from Cognitive Style," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 8, Issue 8, pp. 136-143, 2026.

mental activity that functions to formulate or solve problems, make decisions, and seek reason. This is in line with Ruggeiro's opinion, which defines thinking as a mental activity to help formulate or solve problems, make decisions, or fulfill *a desire to understand* (Badawi, 2015: 23).

Thinking activities are carried out by a person when formulating a problem, solving a problem, drawing a conclusion or making a decision, and seeking to understand something. Likewise, Peter Reason argues that thinking *is* a mental process that goes beyond simply remembering *and* comprehending . Accoeding ti him, remembering and understanding are more passive than thinking activites. Thinking requires a person to move beyond the information they hear. For example, a person's ability to think is to find new solutions to a problem (Firdaus, 2010: 7).

One of the abilities that must be possessed by students at the elementary and secondary education levels based on the objectives of mathematics learning is critical thinking. Critical thinking is crucial for students to have, as it can help them thinking rationally in addressing current problems and finding alternative solutions to those problems (Karim, 2015: 92).

Zamroni and Mahfudz (2009: 23-29) stated the reasons for the importance of critical thinking skills in students, namely: 1) The rapid development of science and technology will cause the information received by students to be increasingly diverse. Therefore, students are required to have the ability to choose and sort good and correct information so that it can enrich their insight; 2) students are one of the forces with high pressure (people power), therefore in order for that power to directed in the right direction (in addition to a high commitment to morals), they need to be equipped with adequate thinking skills (deductive, inductive, reflective, critical and creative) so that in the future they will be able to take part in developing the fields of knowledge they are studying; 3) students are citizens of society who now and in the future will live increasingly complex lives. This requires them to have critical thinking skills and the ability to solve problems faced critically; 4) critical thinking is the key to developing creativity, where creativity emerges when observing phenomena or problems which will then require us to think creatively, 5) many jobs, both directly and indirectly, require critical thinking skills; 6) at all times, humans are always faced with decisions- making, with skills in critical thinking, humans can make the right decisions.

Mathematical material and critical thinking skills are two things that cannot be separated, because mathematical material is understood through critical thinking, and critical thinking is trained through learning mathematics (Lambertus in Badawi, 2015: 4). According to Wijaya (2010: 72) critical thinking is the activity of analyzing ideas or concepts in a more specific direction, distinguishing them sharply, selecting, identifying, reviewing and developing them in a more perfect direction.

Learning to think critically means using mental processes, such as paying attention, categorizing, selecting, and evaluating/deciding. Nisa (2016: 67) stated that critical thinking, which is a high-level thinking, can be created so that an individual has the ability to think creatively, as well as become a superior problem solver, an appropriate and useful decision maker, and able to convince his opinions, analyze assumptions, and conduct scientific investigations.

Critical thinking also enables students to discover the truth in amidst of the many events and information that surround them every day. This means that through critical thinking, students can distinguish between necessary and unnecessary information, enabling them to discover the truth. Egok (2016: 188) explains that critical thinking is an organized process that enables students to evaluate evidence, assumptions, logic, and language which underlies other people's statements or their own opinions.

Critical thinking is a process of using thinking skills effectively to help someone make, evaluate, and apply decisions based on what they believe or do. Some thinking skills related to critical thinking are comparing, differentiating, estimating, drawing conclusions, influencing, generalizing, specializing, classifying, grouping, sorting, predicting, validating, proving, connecting, analyzing, evaluating, and creating patterns (Siswono, 2016: 14).

Critical thinking is a cognitive activity related to the use of reason. Facione (in Anggiasari et al., 2018: 185) states that critical thinking is thinking that has the purpose of proving something, interpreting what something means, solving problems, but the core of critical thinking is part of *cognitive skills* that include interpretation*,* analysis *,* evaluation *,* inference*,* explanation *,* and self- regulation .

Mathematical critical thinking ability is defined as a series of non-procedural thinking abilities, namely the ability to determine analogies, analysis, evaluation, solve non-routine problems and prove. Critical thinking in mathematics will make students able to organize and combine mathematical thinking through communication, communicate their mathematical thinking coherently and clearly to other students, teachers and others, analyze and evaluate mathematical thinking and strategies, use mathematical language to express mathematical ideas appropriately (Kuniarsih, 2012: 118).

Bayer (Prameswari, et al. 2018: 747) explains the characteristics of critical thinking skills, namely: (1) Character, someone who has critical thinking skills has a skeptical attitude, is very open, respects honesty, respects various data and opinions, respects clarity and accuracy, seeks other different views, and will change the attitudes when there is an opinion that is considered good. (2) Criteria, in critical thinking there must be a criterion or benchmark. To get there, you must find something to decide or believe. Although an argument can be compiled from several learning sources, it will have different criteria. If we are going to apply standardization, it must be based on relevance, accuracy of facts, based on credible sources, thorough, unbiased, free from erroneous logic, consistent logic, and mature consideration. (3) Arguments, which a statements or propositions based on data. Critical thinking skills will include the activities of recognizing, evaluating, and compiling arguments. (4) Consideration or thinking, i.e. the ability to summarize conclusions from one or more premises. The process will include activities to test the relationship between several statements or data. (5) Point of view *,* which is the way of

Zamsir, Hartina Pratiwi La Mela, and Risman Alifin, "Students' Mathematical Critical Thinking Skills Reviewed from Cognitive Style," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 8, Issue 8, pp. 136-143, 2026.

looking at or interpreting this world, which will determine the construction of meaning. Someone who thinks critically will view a phenomenon and various different points of view. (6) *Procedures for applying criteria* , the procedures for applying critical thinking are very complex and procedural. These procedures will include formulating problems, determining decisions to be taken and identifying estimates.

Indicators of critical thinking skills according to Facione include interpretation, analysis, evaluation, and inference. Interpretation is the ability to understand and express the meaning of a problem. Analysis is the ability to identify and conclude relationships between statements, questions, concepts, descriptions, or other forms. Evaluation is the ability to assess the credibility of statements/representations and to logically assess the relationships between statements, descriptions, questions, and concepts. Inference is the ability to identify and obtain the elements needed to draw conclusions (Anggiasari et al. 2018: 185).

This study uses four indicators of critical thinking skills developed by Karim (2015: 95) which refers to Facione as an indicator of critical thinking ability, namely:

1. Interpretation, that is, understanding the problem shown by writing what is known and what is asked in the question correctly.
2. Analysis, which is, identifying the relationships between statements, questions, and concepts given in the problem by making an appropriate mathematical model and providing an appropriate explanation.
3. Evaluation, which is using the right strategy in solving problems, complete and correct in making calculations.
4. Inference, that is, making conclusions correctly.

SMP Negeri 4 Kendari is a school located in Kendari City, Southeast Sulawesi Province. According to information from the eighth-grade math teacher, In the 2020/2021 academic year at SMP Negeri 4 Kendari, student involvement in learning was not optimal. Students are less daring to ask questions when given the opportunity by the teacher. One of the abilities seen in students with critical thinking skills is being able to ask questions and be active in learning. Students' critical thinking skills were also seen in the student worksheets concerning their mathematical critical thinking skills, which showed that several indicators that are considered unfulfilled, such as not understanding the problem in the problem, making incorrect mathematical models, making errors in calculations, and not concluding the solution to the problem. Seeing the problems that arise, especially those related to mathematical critical thinking skills, it is necessary to analyze students' mathematical critical thinking skills first so that the solutions provided are appropriate, effective, and efficient.

When developing critical mathematical thinking skills, each teacher is faced with students who have different characteristics from one individual to another. One dimension of student characteristics that specifically needs to be considered is cognitive style. Cognitive style is one of the learning condition variables that teachers need to consider when designing learning, especially in selecting learning strategies that suite to students' cognitive styles. Cognitive style is a form of cognitive activity. Cognitive style distinguish individuals in interpreting, thinking, solving problems, learning, the ability to relate, making decisions, and so on (Wulan and Rusmala, 2019: 126).

Students' critical thinking skills are closely related to cognitive aspects, namely how to complete a task, explain existing information in problem solving, design procedures, and provide appropriate solutions in solving problems (Desmita, 2012: 135). Thus, cognitive style will affect the level of students' critical thinking skills because each student has a different way of thinking, organizing and processing information. Wolfolk (in Bowo, 2017: 8) shows that in cognitive style there is a different way to see, recognize, and organize information. Each individual will choose their preferred way of processing and organizing information in response to environmental stimuli. Some individuals respond quickly and others are slow.

This way of responding is also related to personal attitudes and qualities. A person's cognitive style can be seen in individual variations in attention, information reception, memory, and thinking that emerge or differ across personality cognitions. Cognitive style is referred to as a style, not as an ability, because it refers to how a person processes information and solves problems, not refers to how the process of solving is best done.

Cognitive style indicate the variation between individuals in their approach to a single task, but that variation cannot indicate a particular level of intelligence or ability. As a behavioral characteristic, individuals with the same cognitive style do not necessarily have the same ability. Each cognitive style has adaptive value in specific circumstances. It cannot be said that someone who scores higher on a cognitive style is better in every situation than someone who scores lower on a cognitive style test.

Research conducted by Khairat (2019: 24) shows that there is a significant relationship between students' cognitive style and students' mathematical critical thinking, so that cognitive style has a significant influence on the development of students' critical thinking abilities. This research focuses on cognitive styles that are distinguished based on psychological differences, namely *field-dependent* cognitive styles and *field-independent* cognitive styles . Witkin's research (Wulan, 2019: 130) shows that the *cognitive style approach, based on field-independent* and *field-dependent* dimensions, is useful when applied to educational issues. *The field-independent* and *field-dependent dimensions* have an impact on the world of education, regarding how students learn, how teachers teach, how students and teachers interact, and how students make decisions.

Field dependent (FD) and *field independent (FI)* cognitive styles are types of cognitive styles that reflect a person's analytical way of interacting with their environment. Crowl *et al* (in Rifqiana, 2015: 34-35) define *field independent cognitive style* as a person's cognitive style with a high level of independence in observing a stimulus without dependence on external factors and less able to cooperate. When individuals who have this cognitive style are faced with complex and analytical tasks, they tend to do it well, and if successful, they are enthusiastic about doing more difficult tasks and they

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prefer to work independently. *Field dependent cognitive style* as a person's cognitive style tends to be very dependent on external sources of information and cooperates better with others. This cognitive style has characteristics that tend to be better at recalling social information such as conversations and the overall picture of the given context. The basic characteristics of both cognitive styles are very suitable for application in research involving critical thinking processes in mathematical problems.

The individual cognitive styles of *Field-dependent* (FD) and *field-independent* (FI) has their own characteristics. Both FD and FI individuals have strengths and weaknesses depending on their respective fields. Both cognitive styles are crucial in the learning process. Identifying the students' cognitive styles will help teachers make decisions about the learning approaches. The differences in individual characteristics of FD and FI can be seen in the following table.

TABLE 1. Difference characteristics of FD and FI according to Witkin

No	*Field Dependent*	*Field Independent*
1	Strive to reorganize information and forge connections with prior knowledge.	Able to reorganize a context of initial/previous knowledge
2	Personality shows a tendency towards social	Slightly influenced by social intensification
3	In proving something, we tend to use less reasoning skills.	In proving something, we tend to use more reasoning skills.
4	Prefer to study in groups	Prefer to study alone
5	Influenced by the figures	Work individually
6	Externally directed	Internally directed
7	Receive ideas directly	Receive reinforcement of ideas through analysis

The differences between these two cognitive styles will result in different critical thinking skills, especially in mathematics learning. Agoestanto (Khairat, 2019: 19) stated that the relationship between cognitive style and mathematical critical thinking skills also shows that *field-independent students are better than field-dependent students* in drawing conclusions, guessing, making deductions, and evaluating arguments. Rifqiana's research (2015: 206) shows that the critical thinking skills of subjects from the strong group are better than those of subjects from the weak group for each of *the field dependent* and *field independent* cognitive styles.

II. METHODOLOGY

The type of research used was qualitative descriptive research. To obtain in-depth data descriptions of students' mathematical critical thinking abilities reviewed of cognitive style, students were given cognitive style tests, mathematical critical thinking ability tests, followed by and interviews. The data of the student test results and data of interview were combined and then described qualitatively. The results were in the form of written, spoken, or descriptive words from the research subjects and then analyzed.

This research was conducted in the even semester of the 2020/2021 academic year at SMP Negeri 4 Kendari. The subjects of this research are four students in grade $VIII_4$ SMP Negeri 4 Kendari. The selection of subjects was determined based on the cognitive style test developed by Witkin (1971) and translated by Ulya (2014) and has been tested for validity and reliability, namely GEFT (*Group Embedded Figures Test*). The criteria for determining cognitive style are if the GEFT score is in the range of 0-11 then the student has a *field dependent* (FD) cognitive style. Meanwhile, if the GEFT score is in the range of 12-18 then the student has a *field independent* (FI) cognitive style. This is in accordance with Witkin's research (in Rifqiana, 2015: 35-36) that subjects who are able to place 12 or more simple images are described as having a *field independent cognitive style* . Subjects who are unable to place more than 11 images are described as having a *field dependent cognitive style* . Individual scores above the national average GEFT score of 11.4 are classified as having a *field independent cognitive style.* The number of research subjects selected was four people.

The method of determining subject : (1) the results of the GEFT scores of students who took the test, sorted from the smallest score to the largest score; (2) students are classified into FD students with a score range between 0-11 and FI students with a score range of 12-18 so that 2 groups of students are obtained, namely the FD group and the FI group; (3) determine the middle value of the FD group by dividing the FD group into 2 parts, namely the weak group if the GEFT score is less than or equal to the middle value of FD and the strong group if the GEFT score is more than the middle value of FD; (4) determine the middle value of the FI group by dividing the FI group into 2 parts, namely the weak group if the GEFT score is less than or equal to the middle value of FI and the strong group if the GEFT score is more than the middle value of FI; (5) determine the middle value of the weak FD group, the middle value of the strong FD group, the middle value of the weak FI group and the middle value of the strong FI group by considering the distance of the score with other cognitive styles. Furthermore, the FD subjects from the weak group are called Weak FD (FDL), while the FD subjects from the strong group are called Strong FD (FDK). FI subjects from the weak group are called Weak FI (FIL) and FI subjects from the strong group are called Strong FI (FIK).

There are two types of instruments in this research, namely the main instrument, that is the researcher and the auxiliary instrument, that is, *the Group Embedded Figures Test* (GEFT), Mathematical critical thinking Test and interviews. GEFT (*Group Embedded Figures Test*) is a form of test used to determine a students' cognitive styles developed by Witkin in 1971. GEFT is a standard test in America so changes to GEFT are as little as possible. Thus, this tool does not need to be tested or developed. This GEFT test has been measured for its reliability level by previous researchers. The value obtained from the Alpha Cornbach reliability is 0.84, meaning that the reliability of this GEFT is very high (Ulya, 2015: 4). This GEFT consists of 3 parts. Part I consists of 7 questions, part II and part III each consist of 9 questions. Part I has a 3-minute working time, while parts II and part III each have a 6-minute working time (Moertiningsih et al., 2012: 43) . Part I is an introduction or practice to familiarize with the test while the score is calculated from parts II and part III. The test is completed by finding simple shapes hidden within a more

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complex pattern, then bolded using a pencil. Students who complete a section faster are not allowed to proceed to the next section because all students start working simultaneously on each section. Scores on sections II and III are scored 1 for each correct answer and 0 for each incorrect answer. Then the scores for sections II and III are added together. If the final score is in the range of 0-11, the student has a *field-dependent cognitive style* . Meanwhile, if the final score is in the range of 12-18, the student has a *field-independent cognitive style* .

The mathematical critical thinking ability test in the form of a descriptive test aims to determine the extent of students' mathematical critical thinking abilities. In this study, the material used for the mathematical critical thinking ability test is the material of flat-sided solids, namely prisms. The number of questions is 2 items with a time allocation of 40 minutes. Before being used, the mathematical critical thinking ability test instrument was first validated by validators consisting of 2 UHO mathematics education lecturers and 1 subject teacher of SMP Negeri 4 Kendari. The validity test applied is a panelist test that aims to see the opinions of experts regarding the instrument that has been created.

Interviews are used to gather as much information as possible about the what, why, and how of a given problem. These interviews contain questions aimed at gaining a deeper understanding of students' critical mathematical thinking skills.

The interview method used is an unstructured interview with the following provisions: (a) the interview questions asked are adjusted to the problem-solving conditions carried out by students (both written and explanatory); (b) the questions asked do not have to be the same as those written in the interview guide, but contain the same core problem; (c) the interview can be conducted in more depth depending on the situation and condition of the respondent. This means that if students experience difficulties with certain questions, they will be encouraged to reflect or given simpler questions without losing the core problem (Adibah, 2015: 119).

The data collection techniques in this study were tests and interviews. There were two types of tests, namely *the Group Embedded Figures Test* (GEFT) and a mathematical critical thinking ability test. GEFT was used to determine students' cognitive styles based on their psychological differences, namely *field-dependent cognitive styles and field-independent* cognitive styles. The timing of the GEFT test followed the direction of the eighth-grade mathematics teacher of SMP Negeri 4 Kendari, which was after class hours in VIII [4.] The results of the GEFT test were then analyzed so that four research subjects were selected to be given a mathematical critical thinking ability test. Furthermore, the administration of the mathematical critical thinking ability test was used to measure students' mathematical critical thinking ability in solving problems on the prism material as many as two questions. The timing of this mathematical critical thinking ability test was according to the agreement between the researcher and the research subjects with the aim of not disrupting school hours. Interviews were conducted after the research subjects had completed the mathematical critical thinking ability test. The interview method used in this study was an unstructured interview in the form of a list of questions asked by the researcher to the research subjects. This interview was conducted with the four subjects on the same day.

The technique for checking the validity of this research data is by using triangulation. Triangulation is a data validity checking technique that utilizes something other than the data itself for checking purposes or as a comparison against the data. In this study, the researcher used technical triangulation. Technical triangulation is triangulation by comparing data collected using different techniques, namely a test technique in the form of a mathematical critical thinking ability test and a non-test technique in the form of interviews on the same subject, namely the research subject determined by the researcher. The results of the mathematical critical thinking ability test and interview data were then analyzed.

Techniques are data analysis processes that begin with reviewing all available data from various sources, including interviews, observations written in field notes, personal documents, official documents, drawings, photographs, and so on (Moleong, 2012: 103). Qualitative data analysis is inductive, meaning that the analysis is based on the data obtained, and then certain relationship patterns are developed to draw conclusions. Data presentation, data reduction, and conclusion drawing are the data analysis methods employed in this investigation. Data reduction is summarize data and select things appropriate subject with focus research. Data reduction is something form analysis that classifies, directs, searches themes and patterns, discarding the unnecessary and necessary ones. The data that has been reduced will give a clearer picture clear, and makes things easier for researcher do further data collection and searching for it when required. Data presentation (*data display*) in research qualitative can done in form description short or narrative, chart, and relationship between category. Data presentation includes classification and identification data, writing organized and categorized data collection so that can withdrawn Conclusion. The data collected were in the form of cognitive style test results using GEFT, the results of the research subjects' mathematical critical thinking ability test, the results of the researcher's interview transcripts with the research subjects regarding mathematical critical thinking ability, and documentation. Presentation of data used in this study is the narrative text. Withdrawal conclusion (*conclusion drawing/verification*) is stage end in do data analysis. Third component namely, data reduction, data presentation, and data extraction conclusion characteristic of each other Interactive. Students' cognitive styles are determined by analyzing the outcomes of the Group Embedded Figures Test (GEFT). Furthermore, by paying attention to the results of the mathematical critical thinking ability test and the results of the interview, researchers can draw conclusions to determine the extent of the research subjects' mathematical critical thinking abilities based on their cognitive styles.

III. Result and Discussion

Determined style cognitive student class VIII [4] SMP Negeri 4 Kendari based on results analysis filling GEFT

Zamsir, Hartina Pratiwi La Mela, and Risman Alifin, "Students' Mathematical Critical Thinking Skills Reviewed from Cognitive Style," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 8, Issue 8, pp. 136-143, 2026.

instrument obtained data from 24 students who were included student *field dependent* and *field independent students* , respectively, as many as 15 and 9 students. From the GEFT results, students style cognitive *field dependent* divided into two groups that is group weak as many as 8 students and groups strong as many as 7 students. Then from group weak, chosen mark middle from group the as Weak *Field Dependent* (FDL). While from group strong, chosen mark middle from group the as Strong *Field Dependent* (FDK). Students style cognitive *field independent* is also divided into two groups that is group weak as many as 5 respondents and groups strong as many as 4 respondents. Then from group weak, chosen mark middle from group the as *Field Independent* Weak (FIL). While from group strong, chosen mark middle from group the as Strong *Independent Field* (FIK). Therefore, four students were selected, namely FDL, FDK, FIL, and FIK as research subjects.

After selecting the subjects, the four subjects were given a mathematical critical thinking ability test and interviewed. The data, including the critical thinking ability data, the interview data, and the triangulation results for each subject, were then analyzed.

1. *Field Independent Subjects (FIL) and Strong Field Independent Subjects (FIK)*

From the results of the mathematical critical thinking ability test and subject interviews, the indicators of mathematical critical thinking ability achieved by the subjects were then determined. The following is an analysis of the mathematical critical thinking ability of the Weak *Field Independent* (FIL) and Strong *Field Independent* (FIK) subjects.

TABLE 2. Mathematical Critical Thinking Ability Subject Cognitive Style *Field Independent* Weak and Strong *Field Independent* (FIK)

Indicator	Weak FI	Strong FI	Comparison
Interpretation	Able to formulate problems and facts	Able to formulate problems and facts	Both FI subjects were able to formulate problems and facts in questions by writing down what was known and what was asked correctly.
Analysis	Able to determine mathematical models	Able to determine mathematical models	Both FI subjects were able to determine the mathematical model correctly.
Evaluation	Able to determine the right strategy	Able to determine the right strategy	Both FI subjects were able to determine the strategy for all questions correctly
Inference	Unable to determine appropriate conclusions	Able to determine appropriate conclusions	The FIL subjects were unable to determine the correct conclusion on both questions, while the FIK subjects were able to determine it. conclusion of the second question.

2. *Field Dependent Subjects (FDL) and Strong Field Dependent Subjects (FDK)*

From the results of the mathematical critical thinking ability test and subject interviews, the indicators of critical thinking ability were then determined.

The mathematical abilities achieved by the subjects. The following is an analysis of the mathematical critical thinking abilities of Weak *Field Dependent* (FDL) and Strong *Field Dependent* (FDK) subjects .

TABLE 3. Mathematical Critical Thinking Ability of Subjects with Weak *Field Dependent Cognitive Style* (FDL) and *Field Dependent* Strong (FDK)

Indicator	Weak FD	Strong FD	Comparison
Interpretation	Able to formulate problems and facts	Able to formulate problems and facts	Both FD subjects were able to formulate problems and facts in questions by writing down what was known and what was asked correctly.
Analysis	Less able to determine mathematical models	Able to determine mathematical models	The FDL subjects were less able to determine the mathematical model for both questions, while the FDK subjects were able to determine the mathematical model for all questions.
Evaluation	Less able to determine the right strategy	Less able to determine the right strategy	Both FD subjects were less able to determine strategies for the entire question.
Inference	Unable to draw appropriate conclusions	Unable to draw appropriate conclusions	Both FD subjects were unable to conclude both questions

This research result show that the ability thinking critical mathematical FDL and FDK subjects have a number of similarities and differences. Similarities that located on the indicator interpretation, the indicator in this case, FDL subjects and FDK subjects are able to interpret question. FDL and FDK Subject write all known information and write it down problems that must be completed with right . On the indicator analysis, FDL subjects and FDK subjects have differences. FDL subjects write mathematical models from question however wrong and lacking complete. Whereas FDK subjects are able to connect between known information with the strategy that will used for finish question with determine the mathematical model with correct and complete from overall the questions given. This is in accordance with study Khoiriyah *et al.* (2013: 243) which shows that category subject with style the same cognitive No always the same way in own level think.

On the indicator evaluation, based on results tests and interviews, both FD subjects less capable do evaluation. FDL Subject and FDK not enough capable determine the right strategy for finish question. Although subjects know formula, however subject not enough capable apply to use it. Both the subject does not understand the concept. The subject is also lacking in understand the steps that must be taken done for finish problem. This is in accordance with one of them

Zamsir, Hartina Pratiwi La Mela, and Risman Alifin, "Students' Mathematical Critical Thinking Skills Reviewed from Cognitive Style," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 8, Issue 8, pp. 136-143, 2026.

characteristics individual *field dependent,* that is in prove something tend not enough use skills reasoning. On the indicator inference, subject cannot conclude problem. This influenced by indicators previously that is indicator evaluation. If one of the from indicator No fulfilled, then confirmed subject will not capable finish problem with right and correct, so that, both FD subject no capable determine the right conclusion.

Subject *Field Independent* own similarities and differences. On the indicators interpretation, FIL and FIK subjects are able to interpret question. Both FI subjects write all known information as well as can describe condition problem with right and write problems that must be completed with right . That is in line with study previously conducted by Ngilawajan (2013: 77) who explained that subject *field independent* and *field dependent* accept information with method read question with careful and thorough furthermore subject manage information shown from answer subject that is mention things that are known and things that are asked from question. On the indicator analysis, FIL subject is able connect between known information with the strategy that will used for finish problem with writing mathematical models from question with correct and complete. Likewise, with FIK subjects, who are capable determine the mathematical model with correct and complete. Based on the method proposed by the FI subject in making a solution plan, by making the information contained in the problem into a picture and the subject's accuracy in determining the formula that will be used to solve the problem, it shows that the FI subject is able to fulfill the analysis indicators . This in accordance with one of them characteristics individual *field dependent*, namely being able to reorganize a context of initial/previous *knowledge*

On the indicator evaluation, both FI subject is capable do evaluation. FIL and FIK subjects are able to determine strategy and can apply knowledge and concepts that he has for finish problems with right. FI subject can understand steps that must be taken done for finish problem and complete and correct in carrying out calculations. This in line with opinion Ngilawajan (2013: 80) states that that FI subject is capable process information shown with linking information received from question with the knowledge he has. Agung and Risky (2014: 210) also explain that FI students are able emit all his abilities in solve something problem when given freedom. The difference between FIL and FIK lies in the indicators inference. The FIL subject does not specify conclusion although capable finish interpretation, analysis and evaluation. On the other hand, FIK subjects are able to determine conclusion correctly.

Related with ability critical thinking mathematical students, description on subject *Field Independent* show performance more Good if compared to subject *Field Dependent*. Mathematical critical thinking ability between FDL subjects and FDK subjects is No the same, so are the mathematical critical thinking abilities between FIL subjects and FIK subjects have differences. Abilities think critical mathematical subject from strong group more Good than subject from group weak. This is in line with Rifqiana's research (2015: 206) which shows that the critical thinking skills of subjects from the strong group are better than those of subjects from the weak group for each *field dependent* and *field independent* cognitive style.

IV. Summary and Conclusion

Mathematical critical thinking skills of students' style cognitive *Field Independent* is as following. Students style cognitive *Field Independent* Weak (FIL) is capable fulfil indicator interpretation, able fulfil indicator analysis, able fulfil indicator evaluation, and no capable fulfil indicator inference. Students style cognitive *Field Independent* Strong (FIK) is capable of fulfil indicator interpretation, able fulfil indicator analysis, able fulfil indicator evaluation, able fulfil indicator inference.

V. Recommendation

According to the findings of this study, mathematics instructors should take into account students' cognitive styles, including both field-dependent and field-independent ones, while teaching. The purpose of this is to enhance students' capacity for critical thinking in mathematics.

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