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Exploration of the Critical Thinking Disposition of Grade 1 Elementary School Students in Implementing the Integrated Mathematical Cognition Learning Flow

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ABSTRACT: *Education is not only a transfer of knowledge, but is also useful for developing 21st century skills. One of the 21st century skills is critical thinking. The aim of this research is to explore the critical thinking disposition of grade 1 elementary school students in implementing the Mathematical Cognition integrated learning pathway. This research is a qualitative descriptive study that takes into account the results of learning observations. The disposition questionnaire was prepared based on a Likert scale with four answer choices, namely Very Often (SS), Often (SR), Sometimes (KD), Rarely (JR). The instrument used was adapted from the National Council of Teachers of Mathematics (NCTM) which consists of 26 statements with 11 indicators. From the research, students have a sufficient disposition to ask questions clearly and with reason (52%), have an attitude or view that something is part of a complex whole (49%), try various strategies (56%), be open, flexible (51%), dare to take a position (47%), act quickly (47%), and utilize other people's critical thinking (54%). The strong category of indicators is trying to understand well (61%), using trusted sources (61%), being sensitive to other people's feelings (63%), while in the criteria there are few indicators, returning/relevant to the main problem (29%).*

KEYWORDS -*Critical thinking disposition, learning flow, mathematical cognition*

I. INTRODUCTION

The goal of education today is to equip students to face life after graduation, so that learning is more than just a means to impart knowledge to be successful in the future, students need to acquire 21st century skills, which can be developed through education [6]. Education is one of the most important things that people need because it gives them access to lifelong learning that can be tailored to their interests and desired field of study. The success of educational goals is closely related to the quality of the learning experience. Learning according to [12] is "teaching students using educational principles and learning theories which are the main determinants of educational success". Indonesia has the lowest level of reading, mathematics and science proficiency in the world, according to the latest PISA (Program Internationale for Student Assessment) assessment, which was conducted in 2018 and published in 2019. Of the 81 countries in the world, Indonesia is the country with the highest level of reading proficiency. , mathematics and science are the lowest in the world. placed 75th. Acquiring mathematical knowledge is not enough to improve the cognitive domain but must be in line with the

affective domain. This is due to the fact that attitudes towards mathematics and mathematics achievement are positively correlated [1]. Mathematics learning is associated with the formation of interest in the subject as a powerful means of problem solving, in addition to understanding concepts, procedures and applications.

Mathematical disposition is a tendency to think and act in a positive way towards mathematics. This is manifested in positive actions, including self-confidence, curiosity, perseverance, enthusiasm for learning, persistent in facing problems, flexible, willing to share with others, effective in mathematical activities (*doing math).*

Apart from activities in studying mathematics, disposition can also be interpreted as changes in appreciation and attitudes towards mathematics, as well as actions in learning mathematics, the more proficient a person is in mathematics, the greater their attitude and appreciation towards mathematics [9] [5] . Meanwhile, critical thinking disposition can be interpreted as the tendency to think and behave critically towards mathematics. According to [11] someone who has a critical thinking disposition also has the following characteristics: asking questions clearly and with reason; try to understand well; use reliable sources; consider the situation as a whole; trying to stay relevant to the main problem; refers to the problem of hope;' looking for various alternatives; be open; dare to take a position, and act quickly; holds the view that something is part of a complex whole; utilize other people's critical thinking; and be sensitive to other people's feelings. [4] critical thinking is one of the fields of study that is cultivated in schools and is seen as a potential solution to current world problems.

In fact, it is widely acknowledged that the primary goal of education is critical thinking. Furthermore, [8] found that a certain set of abilities and attitudes are needed for critical thinking. Critical thinking disposition, in addition to ability, is an important component of critical thinking, although most theories suggest that it is a complex construct that is integrated through motivation and habits of mind. This is in line with what [7] stated that critical thinking is the result of the integration of two crucial elements, namely disposition skills and cognitive abilities. Students' abilities to analyze, conclude, evaluate, explain, and self-correct problems, decisions, or judgments are referred to as cognitive skills. On the other hand, dispositions are habits of mind that are integrated into beliefs or actions that are conducive to critical thinking.

Students with dispositional skills are also more likely to use cognitive abilities when solving problems and making decisions that require higher order thinking. A person with a strong critical thinking tendency is internally motivated to use critical thinking to solve problems and make decisions, according to Facione and Carroll (2013) [11]. Critical thinking skills enable someone to study the problems faced systematically, face various challenges in an organized way, formulate innovative questions and design original solutions (Johnson, 2002). Glazer (2000) further stated that critical thinking contains abilities and dispositions combined with knowledge, mathematical reasoning abilities, and previous cognitive strategies, to generalize, prove, and access mathematical situations reflectively.

Learning flow (learning trajectory) is a situation that describes how students think and learn about something according to their respective understanding and abilities. The learning flow contains hypotheses (conjectures) regarding student learning activities in accordance with the learning activities (flow) designed by the teacher in the form of a Hypothetical Learning Trajectory (HLT) (Walt, 2013) [1]. [10] states that mathematics learning trajectories can support teachers in creating models of students' thinking and restructuring teachers' understanding of mathematics and reasoning. Learning trajectory is a description of the route of development of students' level of thinking in learning certain mathematical material through a series of instructional tasks and learning objectives designed to elicit hypothesized responses (Clement & Sarama, 2004) [13].

Mathematical Cognition is a cognitive processing of mathematics in the realm of numbers and mathematics. This process involves mental and structural reasoning and thinking about numbers and mathematics, as well as solving arithmetic problems. Its primary focus is on the effect size of the problem, a measure of the effect of one's knowledge, because it focuses on the theoretical use of cognitive processes in arithmetic. Influence that considers processing aspects, namely the role of working memory in mathematical processing. Cognitive in this case considers the mainstream examining cognitive processes and structures inferred from response latencies, error rates, verbal reports, as well as event-related potentials and image-based

scanning techniques (Ashcraft & Guillaume, 2009). From the various explanations related to the mathematical cognition integrated learning flow above, it is considered that it can facilitate students in learning mathematics, and will reveal students' critical thinking dispositions in completing the tasks given. This research aims to explore the critical thinking disposition of grade 1 students at SD N 5 Surau Gadang.

II. RESEARCH METHODS

The research method used is descriptive qualitative. Apart from the researcher as the main instrument, this research also used several instruments to obtain supporting data, namely the student critical thinking disposition questionnaire. .The instrument used to determine critical thinking disposition was adapted from NCTM (1989). The instrument used consists of 26 questions in the form of a Likert scale with 4 response scale options starting from "Strongly Disagree" to "Strongly Agree". The instruments used generally have moderate reliability with Cronbash's alpha of 0.645 (Quinn et al 2020). The NCTM instrument (1998) [9] measures 11 types of critical thinking dispositions, namely: Asking questions clearly and with reason, Trying to understand well, Using reliable sources, Having the attitude or view that something is part of a complex whole, Returning/relevant to the main problem, Trying various strategy, be open, flexible, dare to take a position, act quickly, be sensitive to other people's feelings, and utilize other people's critical thinking. Indicators of critical thinking disposition and distribution of questions can be seen in Table 1.

Table 1. Indicators of Students' Critical Thinking Disposition

Critical Thinking Disposition Indicator	Description	Statement Number	
		Positive Negatives	Negatives
Ask clearly and with reason	I asked for a detailed explanation of a math problem; I asked about familiar math problems/problems; I asked for an explanation of the dissertation mathematics material with examples and reasons.	1,3	2
Try to understand well	I try to memorize the contents of a material description or solving a math problem; I asked for a classification of questionable math questions; I study a mathematics topic from various learning sources.	5, 6	4
Use trusted sources.	I checked the correctness of the mathematics learning resources that were viewed; I immediately assumed that the existing mathematics learning resources were trustworthy.	7	8
Having the attitude or view that something is part of a complex whole.	I view a math problem as part of another, more complex math problem; I analyze a mathematical problem from various points of view	9, 10	-
Back/relevant to the main problem.	I encourage discussions about learning mathematics to expand into discussions of other things; when the learning discussion gets wider, I try to return to the original goal; I	12, 13	11

	submitted a rebuttal/suggestion beyond the original problem.		
Try different strategies.	I am looking for alternative strategies for the mathematical solutions that have been produced; I offer various alternative strategies for solving mathematical problems; I feel it is safer to apply strategies in solving familiar math problems.	14, 15	16
Be open, flexible.	I reject opinions that differ from my own; I can accept different opinions from friends/other people;	18	17
Dare to take a position.	I feel safe saying I agree with my friend's opinion; I am afraid to take a position that is contrary to the opinions of friends/others; I dare to say "no" when I have a different opinion with friends/other people.	21	19,20
Act fast.	I act quickly in certain circumstances because it is smart to do so; In my opinion, acting quickly is an action that is not based on consideration (careless).	22	23
Be sensitive to other people's feelings.	I feel happy with the success of other friends	24	-
Utilize other people's critical thinking.	I learned how prominent people/friends who were superior to me thought; I try to take advantage of superior friends' ideas.	25, 26	-

Source: Processed Research Data

After the critical thinking disposition scale was calculated, it was analyzed based on the criteria developed by Riduwan (2012) which can be seen in Table 2.

Table 2. Critical Thinking Disposition Interpretation Criteria

Nilai	Keterangan
0% ≤ x ≤ 20 %	Very weak
20% < x ≤ 40 %	Weak
40% < x ≤ 60 %	Enough
60% < x ≤ 80 %	Strong
80% < x ≤ 100%	Very strong

Source: Processed Research Data

III. DISCUSSION RESULT

This research consisted of 22 students as research subjects who were given a questionnaire consisting of 26 statement items. These statement items are divided into two parts, namely 17 positive statements and 11 negative statements. The Likert scale questionnaire prepared presented four options, namely SS (very often), S (Frequently), KD (Sometimes), and JR (Rarely). Neutral answer choices are not used so that students answer

consistently and to avoid answers that do not match the statement. This is in line with the opinion of Somantri, Ating and Sambas Ali Muhidin (2014), who stated "Each Likert item must be clearly positive and negative by paying attention to the object of the attitude. Neutral items are not included in the Likert scale." The student critical thinking disposition questionnaire consists of 26 statements containing 11 indicators.

Table 3. Student Critical Thinking Disposition Activity Data

Critical Thinking Disposition Indicator	Percentage	Category
Ask clearly and with reason	52	Cukup
Try to understand well.	61	Kuat
Use trusted sources.	61	Kuat
Having the attitude or view that something is part of a complex whole.	49	Cukup
Back/relevant to the main problem.	39	Lemah
Try different strategies.	56	Cukup
Be open, flexible.	51	Cukup
Dare to take a position.	47	Cukup
Act fast.	47	Cukup
Be sensitive to other people's feelings.	63	Kuat
Utilize other people's critical thinking.	54	Cukup
Average	52	Cukup

Source: Processed Research Data

From the data above, it can be seen that the score for each indicator shows the critical thinking disposition score obtained by students in the sufficient criteria with indicators of asking questions clearly and with reason (52%), having an attitude or view that something is part of a complex whole (49%), Try various strategies (56%), be open, flexible (51%), dare to take a position (47%), act quickly (47%), and utilize other people's critical thinking (54%). The strong category of indicators is trying to understand well (61%), using trusted sources (61%), being sensitive to other people's feelings (63%), while in the criteria there are few indicators, returning/relevant to the main problem (29%) .

Based on the data obtained, the distribution of critical thinking disposition profiles for each critical thinking disposition statement can be seen in Figure 1.

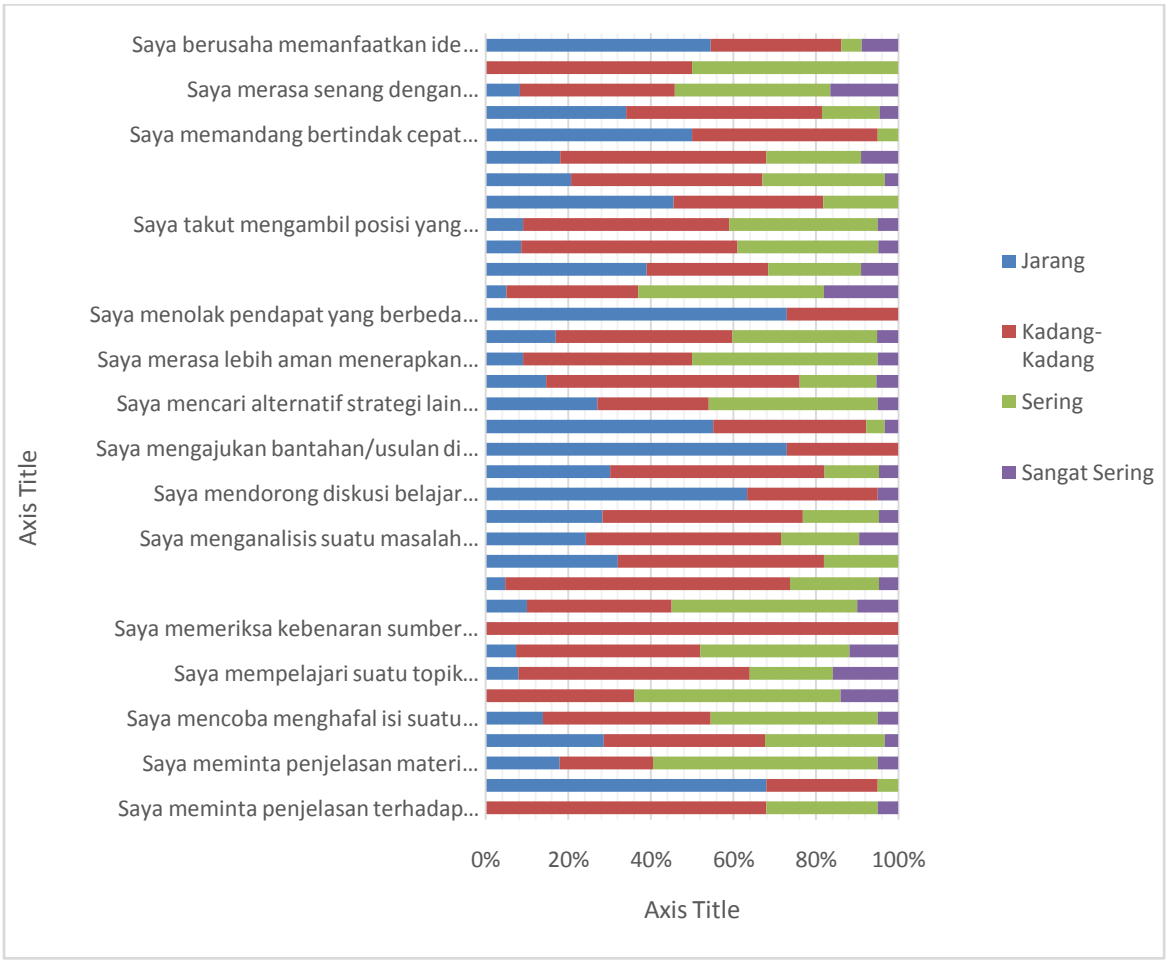

Figure 1. Profile of critical thinking disposition of grade 1 students at SD N 5 Surau Gadang

From the picture above, there are analysis results for each statement, on the indicator of asking clearly and reasoned questions from 22 students who answered Rarely (29%), Sometimes (39%), often (29%) and very often (3%). This is because students still expect the teacher to explain a mathematical problem in detail, so that when explaining the material using an integrated mathematical cognition learning flow, students still ask to be given examples and reasons. On the indicator of understanding well, there are 8% of students who choose rarely, 47% choose Sometimes, 38% often, and 3% choose very often. In this indicator there is a positive statement about students having the courage to ask for classification of questionable mathematics questions and trying to learn a mathematics topic from various sources, so that in the description of the material students no longer try to memorize the content of the material presented by the teacher.

Indicators of using reliable sources include positive statements about students checking the correctness of mathematics learning sources and students still assume existing mathematics learning sources are reliable, so students choose rarely as much as 5%, sometimes as much as 66%, choose often as much as 21% and very often 5%. In the indicators of attitude or view that something is part of a complex whole with a disposition statement that students view a mathematical problem as part of another mathematical problem and students can analyze a mathematical problem from various points of view, it is found that students still choose 28% for rare, 48% for sometimes, 18% for often and 5% for very often. From the indicators of return/relevance to the main problem, there are negative statements about students encouraging discussions about learning mathematics to expand into other discussions, and positive statements about students trying to focus on mathematical problems during discussions and students still making rebuttals/suggestions outside of mathematics problems. From these indicators, students chose rarely 56%, sometimes 38%, often 5% and very

often 3%. These results show that students are still easily disturbed by a negative learning environment, so students still often discuss other problems. Furthermore, on the indicator of trying various strategies, 17% of students chose rarely, 42% chose sometimes, 35% chose often and 5% chose often.

In this indicator, students are still dominant in looking for alternative strategies in solving the mathematics they produce, and often use existing strategies. On the flexible indicator, students chose rarely 39%, sometimes 30%, often 23% and very often 9%. This shows that students still rarely accept different opinions from friends/other people, and reject opinions that differ from their own. This means that many students in the learning process are still silent and do not want to ask questions.

From the data above, it can be seen that the tendency of students' critical thinking disposition at SD N 5 Surau Gadang is in the sufficient category, however there are several indicators that are still weak. This weak critical thinking disposition of students is likely caused by several things, including: 1) Fear of asking: The majority of students are still too shy or afraid to ask about familiar mathematical problems or questions because they believe that by doing so, they will not learn anything. new information about the material studied. 2) The tendency for students' attitudes to decline in understanding learning can be caused by feelings of embarrassment about conveying ideas during the learning process. 3) not having the courage to try, 4) feeling awkward when asked by friends or teachers, it is very likely that the child's curiosity about the learning process is still lacking. 5) Lack of self-confidence when studying makes it difficult for students to explore the information they have.

This is in line with research findings [3] which show that a lack of experience, both knowledge and training, causes people to lack the disposition to think critically. They also tend to be awkward when trying to explore the knowledge they have, afraid to ask questions, and unsure of what decisions are best to make. Looking at the results of the profile of students' critical thinking dispositions that have been presented, it is recommended that the learning carried out consider increasing the disposition on indicators of having an attitude or view that something is part of a complex whole, returning/relevant to the main problem, having the courage to take a position, and acting quickly. [13] emphasize the importance of directing attention to critical thinking. The disposition to pay attention and act will influence cognitive function in a coherent manner (Lavie, 2005). The better the pe's disposition If you pay attention then it is likely that your cognitive function will get better too.

IV. CONCLUSION

From the research carried out, it is known that students at SD N 5 Surau Gadang have critical thinking disposition activities in the sufficient category with indicators of asking questions clearly and with reason (52%), having an attitude or view that something is part of a complex whole (49%), trying various things. strategy (56%), be open, flexible (51%), dare to take a position (47%), act quickly (47%), and utilize other people's critical thinking (54%). The strong category of indicators is trying to understand well (61%), using trusted sources (61%), being sensitive to other people's feelings (63%), while in the criteria there are few indicators, returning/relevant to the main problem (29%).

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