

Analysis of Mathematical Reasoning Ability Viewed from Mathematical Logical Intelligence Middle School Students

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Abstract

Reasoning is one of parts most important in of learning math. However still many students which still confused do problems math especially in questions story SPLDV which really need ability reasoning. For that in research aims to analyze ability reasoning in mathematical terms of intelligence logical mathematical school junior hig research is research study case approach this Subjects in research are this 3 students' class VIII SMPN 188 Jakarta consists of students who have level intelligence logical high moderate and low. The collection data in research this carried outiwith method test, interview and documentation Based on results analysis data ithat obtained iwho student has high level intelligence logical mathematical) S1ifulfills all indicators ability reasoning mathematical in third(questions, student who has level intelligence logical mathematical moderate (S2) only fulfills four indicators ability reasoning mathematical student tin the qand third iwhich has level intelligence logical is low only fulfills three indicator on question number one then, only two indicators for question number two and three.

Keywords

intelligence logical
mathematical; ability reasoning
mathematical



I. Introduction

Mathematics is one of subjects that must study and there in all education starting from kindergarten to level college levelare Mathematics is science which sure and can apply in life daily. Mathematics is a process reasoning, formation attitude objective, honest, formation character and pattern thinking systematic creative as critical for science support ,can take an conclusion (Wanti et al., 2017). In ithis case, according to (BSNP, 2006) That suthis be to given to all elementary starting from school so that is equipped (with ability think logically, analytically, systematic, critical and creative in ability work together to Learning mathematics at school according to (NCTM, 2001) namely problem solving, communication, reasoning, connection, and representation. In process activity learning mathematics required have potential ability reasoning in self student (Saputri, Susanti, and Aisyah, 2017). Mathematics learning presented using Student Worksheets requires active participation from students, because the Student Worksheets are a form of teacher effort to guide students structured through activities that are able to attract students to learn mathematics. In addition, learning with Student Worksheets can make the learning process more effective as expected in each learning that is increasing the creativity of students' thinking so that learning objectives are achieved. (Tarigan, E. et al. 2020)

Reasoning mathematical is one of competencies that need develop in the lesson mathematics at school (Mik, 2018). Therefore ability reasoning mathematical student also is ability to make claims new or draw conclusions by think logical based facts with truth on

which proved (Oktaviana et al, 2021). In case mastered concepts and principles mathematics is requirement initial for success learning mathematics that can continue to stage where higher (Tsurayya and Ningrum, 2021). In practice ability reasoning mathematical student this very important in learning mathematics especially when student get an question about question story ,which where is student, that will think how can deduce conclusion from truth or fact that exists. Ability reasoning student in mathematics learning continuous will give impact positive for therefore because is ability reasoning mathematical students is ability student for can learn reflect and organize skills by develop strategy right for draw conclusions or make statement new.

However, in reasfact that ability still relatively, like research conducted by (Putri Ayu Dwi and Yuliani 2015) that student has level reasoning mathematics is still relatively because there is expi by student is when work on problem namely (1) there low power sreasoning student the in understands concepts mathematics and makes an conclusion at the end of work, (2) low accuracy student when works an problem that have on then student got result which still lacked correct and student didn't check again then result will work, ociof low result study besides , as for factor obstacles other namely student not yet according with indicator ability reasoning mathematical still presence of student still presence of lacking accuracy affected by ,colleagues and still have addition errors in concept operation count subtraction (Fauziah and Ruswana, 2021).

From obstacles that these causes low ability reasoning mathematical, based results observations researchers on students class VIII SMP in City Bekasi with on material SPLDV there are several students who really don't understand concept or formula in working problem the on. At the time learning place was also students can answer but still not right in way systematic it answer question, there is also student who staking can answer but always ask or not independent. As for some from they that do understand about then prefer to anotheractivity then't besides, obstacles other that caused low ability reasoning mathematical student is level intelligence student which has by been given that god. Every student certainly has intelligence which very diverse or different so that case is very influential ability process this reasoning.

A psychologist named Howard Gardner said that there are nine amotypes intelligence are multiple, others vics-linguistics, spatial intelligence kinesthetic, intelligence musical, intelligence interpersonal, intelligence intrapersonal, intelligence naturalist, intelligence existential (Gardner, 2004). The intelligence student is reflected in of attitude which responds and accuracy in understanding an problem that exists draws conclusions and makes decisions intelligence this also very influence in reasoning mathematical for learning mathematics. It is like opinion Willis that intelligence logical mathematics has 5 components namely classification, operation compare, arithm, reasoning inductive and is deductive, and form hypothesis and examines again hypothesis that has made (Willis and Johnson, 2001). Intelligence ilogical mathematical is an ability human which can acquire knowledge from pattern certain or a certain logic (Made, 2016), because that can say intelligence logical mathematical is an skill scientific used in study a concept and procedurally of can connect various patterns abstract to solve an problem. Thus, ability reasoning has relation to intelligence logical mathematical person. In addition that, intelligence logical mathematical is also used students by in abilities reasoning.

There several material mathematics that can use in present problem which relates to ability reasoning in process learning mathematics one them is material in system of are linear two variable or usually is called with SPLDV. In material this student still often has difficulty in solving questions. Focus problem is only on find value of variables x and y which represented in form problem story which relates to life daily.

research has in objectives to analyze ability reasoning mathematical terms of intelligence students logical mathematical high school junior. This In research, researcher chose material SPLDV with context questions story the reason is because students still have lot which difficulty in solving questions related to material.

II. Research Method

This research is research study case with approach research this uses conditions environmental natural to understand social reality qualitative (Sugiyono, 2017). This research qualitative is which birth to invention or discovery which not may produce if use method calculation statistics or method quantitative (Shidiq and Choiri, 2019). Study icase is exploration system limited or one case (or many cases) at a collection which deep and detail which can involve sources information (Manab, 2015).

The sources of data in this research are the results of interviews with students of class VIII SMP Negeri 188 Jakarta and the results of written items on mathematical reasoning abilities. The main data in this research is the mathematical reasoning ability which is obtained from the results of the students' reasoning ability. Then, data supporting inform of data from results test intelligence logical mathematical which form of instrument questionnaire.

In this research, the method of taking the subject is by using purposive sampling is a technique of selecting the subject with the idiom chosen based on a certain criterion. The subjects of this research were selected based on the considerations of the mathematics teacher and the curriculum leader with the criteria as follows are (1) students with grade VIII with high logical intelligence level; (2) the subject matter can be communicated properly; (3) the subject matter can cooperate well with the researcher. The schedule for research activities is as follows.

The technique of collecting data in this research is in the form of items, observations and interviews. In this research, there are two items that are used, namely, item in the form of a questionnaire instrument to measure the logical intelligence of students and the SPLDV problem item to measure students' mathematical reasoning abilities. This imathematical logical intelligence test was carried out in the initial stage, which has the aim of categorizing these subjects based on the high, medium and low level of logical intelligence. Based on test intelligence logical mathematical subject obtained the S1 with category intelligence logical mathematical high, S2 category intelligence logical mathematical moderate and S3 category intelligence logical mathematical low. Then in test ability reasoning mathematical conducted by subject selected namely subject S1, S2 and S3 which has objective to analyze ability reasoning mathematical student. In interview myself here aims to explore an information about abilities students reasoning mathematical addition. The interview that used in research is this interview not structured method. In interview question adjusted to situation subject and prepare first in question which stated the guide interview.

The main instrument in this study was the researcher himself and the supporting instruments used in this study were the student's reasoning ability test related to the SPLDV material, the instrument test of mathematical logistical intelligence, interview and observation guidelines, all of which instruments used in this study were declared valid by validator.

III. Result and Discussion

The results of this research were obtained from the results of the tests that were conducted by students of class VIII at SMPN 188 Jakarta. Based on the results of the mathematical logical intelligence questionnaire, three categories were selected as the research subjects, namely S1 (high), S2 (medium) and S3 (low). The research subjects that were obtained were as follows

Table 1. The results of the questionnaire instrument test results of students' mathematical logical intelligence research

Subject Research	Category
AS (S1)	High
HAS (S2)	Medium
KA (S3)	Low

In ability reasoning mathematical this is for subject research in analysis based on indicators ability reasoning mathematical namely (1) propose conjecture, (2) performing manipulative mathematics, (3) determine pattern or property of a phenomenon mathematical, (4) arrange proof against a truth solution, (5) draw conclusions. Based on the results of test ability reasoning mathematical in terms of intelligence logical mathematical student junior high school class VIII on material SPLDV this obtained data as below.

Table 2. The results test ability reasoning mathematical students based on results work and interviews on subject

No.	Indicator Ability Reasoning Mathematical	Subject								
		S1			S2			S3		
		Problem								
		1	2	3	1	2	3	1	2	3
	Proposing conjecture	√	√	√	√	√	√	x	√	√
	Performing manipulative mathematics	√	√	√	√	√	√	√	√	√
	Determine pattern or property of a phenom on mathematical	√	√	√	√	√	√	√	x	x
	Arrange proofs against a truth solution	√	√	√	√	x	x	√	x	x
	Draw iconclusions	√	√	√	x	x	x	x	x	x

The discussion below is based on results interviews and work questions test ability reasoning mathematical on material SPLDV which from on done by subject as follows.

3.1 Description Answers Students

a. Subject Intelligence Logical Mathematical High (S1)

Based on results interview by student with intelligence logical high which have worked on 3 questions SPLDV (obtained review ability reasoning mathematical as follows.

1. Propose Conjecture
Subject with intelligence logical mathematical high able propose conjecture with both and correct on question number to 1, 2, and 3. Subject able to express which knows and which asks on question with correct and correct.
2. Doing manipulative mathematics
Subject who has intelligence logical mathematical high able make model mathematics or manipulative mathematics with both and correct and subject able to determine which relates with known is and asked and able to make equation linear two variables based which known in problem 1 number is on 2.
3. Determine the pattern or trait of a mathematical symptom
This subject is able to perform the steps or the planning pattern in solving the 1 number problem 2 exactly. Furthermore, the subject is also skilled in carrying out the calculation to find the result of the three questions and is correct in answering the three questions. Subject had no difficulty in this indicator stage.
4. Compiling proof against a truth solution
Subject with intelligence logical high is able prove truth answer when has found result to answer. Subject is also able to solve problem with method elimination and substitution to prove true on when answer question number 1, 2 and 3. Then is subject also can check return or see truth solution for answer problem subject. This also n't can do with method other ito solve third the problem.
5. Draw conclusions
Subjects who have mathematical logic intelligence are able to draw conclusions on numbers 1, 2, and 3. Subjects are able to determine conclusions correctly and precisely and in accordance with the results obtained from the answers to questions.

b. Subject Intelligence Logical Mathematical Moderate (S2)

Based on the results of interview to subject intelligence logical mathematical being which has worked on questions number 1, 2 and, 3 material SPLDV obtained review ability reasoning mathematical students as follows:

1. Propose conjecture
Subject with intelligence logical mathematical while able propose conjecture with both and right. Subject is also able to in express which knows and asked in question number 1, 2, and 3.
2. Perform manipulative mathematics
Subject with intelligence logical mathematical being can make model math or manipulative math with both and are correct. And subject able to determine which relates with known and asked and able to make equation linear two variables based which known in problem is on number 1, 2, and 3.
3. Determine ipattern ior iproperty iof ia iphenomenon imathematical i
Subject is able to do steps or pattern plan in solve problem this number 1, 2, and 3 with exactly. Furthermore, subject is also skilled at in performing calculations for find result from third problem and in exactly the answers third the questions. Subject did not experience difficulty in stage this indicator.
4. Arrange proof against a truth solution

Subject with intelligence logical while this able to prove truth answer when has found result answer on question number 1. However, in iquestions numbers 2 and 3 subject this n't can in prove answer. In question number 2 and 3 still their error or inaccuracy which in results answer still corless. However, Subject is able to solve problem with method elimination and substitution on problem number 1 and for number 2 and 3 still not right. Then, subject isn't using method another in solve third the problem.

5. Draw conclusions

Subject with intelligence logical while this not able draw conclusions into answers subject. This also is not able to in determine truth with true and correct according to result answer which in obtained.

c. Subject Intelligence Logical Mathematical Low (S3)

Based on results interview to subject intelligence logical mathematical low which has worked on questions number 1, 2 and 3 material SPLDV obtained review ability reasoning mathematical students as follows.

1. Propose conjecture

Subject with intelligence logical mathematical low not able propose conjecture with good and correct on question number 1. In question number 2 and 3 subject is able to propose conjecture with both and correct. However, subject able to in express what is known to asked to questions number 1, 2, and 3 with true.

2. Doing immanipulative mathematics

Subjects with low mathematical logical intelligence are unable to make mathematical models or maginative mathematical models properly and correctly and the subject of is able to determine which is related to which is known and is asked and is able to make a linear equation of the two variables based on the known in the nomic equation 1, 2, 3.

3. Determining the pattern or trait of an imathematical symptom

Subjects with low mathematical logical intelligence are able to take steps or plan patterns in solving problem number 1 correctly. However, in questions number 2 and 3 the subject was not able to take the steps or find a rencada pattern to solve these problems. Furthermore, the subject is also skilled in carrying out calculations to find the results of question number 1 correctly in answering it. however, not with questions number 2 and 3. The subject has difficulty in this indicator stage.

4. Arrange proof against an truth solution

The subject with low logical intelligence was able to prove the truth of the answer when the answer to question number 1 was found. However, in questions number 2 and 3 this subject was unable to prove the answer. In questions number 2 and 3 there are still errors or inaccuracies which result in the answers being still inaccurate. However, this subject was able to solve the problem using the elimination and substitution method in question number 1, and for numbers 2 and 3 it was still not correct and had not completed the calculation completely. then, the subject did not use other methods in solving the three questions.

5. Draw conclusions

Subjects with low logical intelligence are not able to draw conclusions in their answers. This subject is also unable to determine the truth correctly and precisely according to the answers obtained.

Based on the description above, it is clear that there is a relationship between logical mathematical intelligence and the mathematical reasoning ability of students in class VIII SMP. In this case, mathematical logical intelligence includes four abilities, including numerical ability, algebraic concept ability, number series ability and logic or reasoning

ability. Therefore, it is clear that this ability is related to the students' mathematical reasoning ability in solving SPLDV questions.

Students who have high mathematical logical intelligence are able to meet all indicators of mathematical reasoning abilities well. students are also able to recognize the patterns contained in the problems and are able to analyze the given mathematical problems, so that students are able to make conjectures, determine what is asked and known in the problem and blindly make mathematical models or algebraic concepts well and correctly, then the student can determine completion plan correctly and precisely in accordance with the SPLDV material and perform calculations correctly. Furthermore, the student is also able to draw conclusions properly and correctly. it is very clear that the ability of mathematical logical intelligence has an effect on students' mathematical reasoning abilities to solve mathematical problems.

At students who have moderate mathematical logical intelligence, only fulfill 4 indicators in question number 1 and meet 3 indicators in questions number 2 and 3. Students are able to make assumptions and are able to determine what is known and asked about these questions correctly, students able to make mathematical models correctly according to what is known in these questions, students are also able to plan and find patterns to solve the three problems, these students are also able to complete calculations and use elimination and substitution methods to compile proof of the truth of the answer to question number 1 , but for questions number 2 and 3 the students are still not able to solve the questions correctly and precisely, then the students have not been able to make or draw a conclusion and students have difficulty in answering the questions accurately.

For students who have low logical intelligence, they are able to fulfill 3 indicators in question number 1 and for questions number 2, 3 these students are only able to meet 2 indicators. This student was not able to make a guess correctly in question number 1, in questions number 2 and 3 this student was able to make a guess correctly. Then, students are able to make mathematical models by tapping on questions number 1, 2, and 3, students are not able to find patterns or plan calculations in solving these problems, then students are also not able to do the elimination and substitution methods correctly and correctly and not able to draw conclusions based on the results of the answers to the problems that have been found.

Based on the results of the research above, it can be seen that the category of logical mathematical intelligence level of students can determine their ability to solve a problem, because the higher the level of mathematical logical intelligence of the student, the better the student has mathematical reasoning abilities in solving mathematical problems. This is in line with the results of Relawati's research that there is a positive influence or relationship between mathematical reasoning abilities and students' mathematical logical intelligence (Relawati, 2021). This is evident in the table below which shows the differences in subjects based on indicators of mathematical reasoning abilities that have high, medium and low mathematical logical intelligence.

Table 3. Differences in subjects		
Subjects with high logical mathematical	Subjects with moderate mathematical logical intelligence	Subject with low mathematical logical intelligence
Submit conjectures		
Able to make assumptions properly and correctly and can find out what is known	Able to make conjectures properly and correctly and can find out what is known	Able to make conjectures properly and correctly and can find out what is known

and asked in questions number 1, 2, and 3.	and asked in questions number 1, 2, and 3.	and asked in questions number 2 and 3 however, not in question number 1.
Doing mathematical manipulatives		
Able to make manipulatives or mathematical models properly and correctly. As well as being able to make linear equations of two variables according to what is known in questions number 1, 2, and 3.	Able to make manipulatives or mathematical models properly and correctly. As well as being able to make linear equations of two variables according to what is known in questions number 1, 2, and 3.	Able to make manipulatives or mathematical models properly and correctly. And able to make linear equations of two variables according to what is known in questions number 1, 2, and 3.
Determine the pattern or nature of a mathematical phenomenon		
Able to determine patterns or plan calculation steps in solving problems correctly and precisely in questions number 1, 2, and 3.	Able to determine patterns or plan calculation steps in solving problems correctly and precisely on questions number 1, 2, and 3.	Unable to determine patterns or plan calculation steps in solving problems correctly and precisely on number questions 1, 2, and 3.
Compile proof of the correctness of the solution		
Able to prove the correctness of the answer and be able to use the method of elimination and substitution to solve problems number 1, 2, and 3 correctly and precisely. However, students cannot use other methods or other alternatives.	Able to prove the correctness of the answer and be able to use the method of elimination and substitution to solve problems number 1, 2, and 3 correctly and precisely. However, students cannot use other methods or other alternatives.	Unable to prove the correctness of the answer and unable to use the method of elimination and substitution to solve problems number 1, 2, and 3 correctly and precisely. However, students cannot use other methods or other alternatives.
Drawing conclusions		
Able to draw conclusions based on the results that have been obtained correctly and precisely.	Unable to draw a conclusion based on the results that have been obtained correctly and precisely.	Unable to draw a conclusion based on the results that have been obtained correctly and precisely.

IV. Conclusion

Based on the results of the research that has been carried out, it can be concluded that the students' mathematical reasoning ability in terms of the mathematical logical intelligence of junior high school students shows various results in each subject. The following are the conclusions from the results of research regarding the analysis of students' mathematical reasoning abilities in terms of the mathematical logical intelligence of junior high school students as follows:

1. This S1 subject is able to go through all the indicator stages in questions number 1, 2, and 3, namely being able to make conjectures, being able to determine mathematical manipulatives, being able to determine the pattern or nature of a mathematical phenomenon, able to compile evidence against the correctness of the solution and be able to draw conclusions.
2. This S2 subject is able to go through the indicator stages of proposing conjectures, able to perform mathematical manipulatives, able to determine the pattern or nature of a mathematical phenomenon, able to compile proof of the truth of problem solving number 1. However, questions 2 and 3 could not pass and could not draw conclusions
3. This S3 subject is only able to go through the indicator stages of proposing conjectures in numbers 2 and 3. However, in number 1 they cannot pass it and are able to perform mathematical manipulatives.

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