

Relationship between The Ability of Mathematical Reasoning and Emotional Quotient (EQ) Students Secondary School

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Abstract. The purpose of this study was to investigate the relationship between mathematical reasoning abilities and student EQ. Setting research in this research was the students of Secondary School class VIII. Three hundred and twelve students participated in this study. They solved the TIMSS model mathematical problem of reasoning type and EQ Goleman test. The results showed that there was a significant positive relationship between mathematical reasoning ability and student EQ Equipped with the relationship between mathematical reasoning ability and each component of EQ.

INTRODUCTION

Reasoning is a basic skill in understanding mathematics. Reasoning making help students develop connections between new learning and their existing knowledge, increasing their likelihood of understanding and retaining the new information. So, high school mathematics programs must give attention to developing these reasoning habits on a containing basis-not as a set of new topics to be taught but as an integral part of the curriculum [1].

Reasoning is a type of high-order thinking skills. Mathematical reasoning refers to the ability to formulate and represent a given mathematics problem, and to explain and justify the solution or argument [2]. [3] suggests that "reasoning is the line of thought adopted to produce assertions and reach conclusions in task solving. It is not necessarily based on formal logic, thus not restricted to proof, and may even be incorrect as long as there are some kind of sensible (to the reasoner) reasons backing it". This suggests that students with good reasoning will be able to provide reasons for each step in solving mathematical problems and make conclusions based on logical thinking. In addition, students who can not give their reason, show that their reasoning is low. Students who lack knowledge of what to do and how to solve the problem in these circumstances will add, subtract, multiply, or divide the numbers they see without giving much thought to their reasons for doing so.

Reasoning allows students to think and gain a deep understanding of knowledge [4]. Some researchs showed that the reasoning supporting better math achievement. [5] showed that success in mathematics reasoning ability reliably predicted success in mathematics attainment, where individuals who demonstrate better reasoning skills display good problem-solving profiles. However, students from some countries have low reasoning. [6] revealed that 8th Grade students showed difficulty in solving problems, in demanding a conceptual understanding of reasoning, and in measuring the surface area and volume of cylinders. [7] found in his study in South Africa that most students lacked conceptual understanding and reasoning skills. Indonesia's student also shows a low level of reasoning. This is shown from the results of TIMSS with the scores obtained are still below international standards [8].

The results of this TIMSS study show that different methods and techniques are required for students to develop reasoning skills. In addition, attention should be paid to factors that influence students' thinking skills and conceptual understanding other than cognitive factors. One such factor is emotion. [9] state, "What we learn is influenced and governed by mindsets and emotions involving hope, personal bias, and prejudice, self-esteem, and the need for social interaction". They maintain that emotion and cognition are inseparable in learning but both are an integral part of the process. This premise is very important for the model presented here.

Emotions act as filters to shape our desires, give our capacity, and to a large extent regulate our immediate thoughts. [10] also agrees that personal emotions are important in - or "central" to critical thinking. This shows that to support the process of thinking a person in obtaining the necessary understanding of intelligence to understand and manage his emotions. Intelligence is called the emotional intelligence.

Emotional Quotient (EQ) is one aspect that can affect how one thinks. According to [11] *Emotional Quotient (EQ)* is the ability of a person to recognize the emotions of self, manage emotions, motivate yourself, recognize the emotions of others (empathy) and the ability to build relationships (teamwork) with others. *Emotional Quotient (EQ)* can help involve the ability to carry out accurate reasoning about emotions and use emotional and emotional knowledge to improve thinking [12]. This is in line with research conducted by [13] states there is a relationship between critical thinking and *Emotional Quotient (EQ)* because in critical thinking provides the mental tools needed to explicitly understand how reasoning works and how the tool can be used to take orders from what we think, feel, desire and do. This shows that emotional intelligence is needed in order to maximize students' thinking ability.

METHODOLOGY

The method used in this research was survey method by collecting and analyzing data quantitatively.

Participants

The population of this research is the students of class VIII in Bengkulu City. Determination of sample using stratified cluster random sampling approach. The selected sample is students from 12 schools consisting of 4 low school, 4 medium school, 4 high school based on 3 year national examination value. Students are 312 students aged 13-14 years old. The student has studied the material on the type of reasoning given.

Instrument

Mathematical reasoning Test

The ability of mathematical reasoning was assessed using the TIMSS type 5 reasoning model problem. The test instrument is validated by content validation and reliability with Cronbach alpha ($\alpha = .858$). Normality of reasoning test scores with the Kolmogorov-Smirnov Sample test, whereas the homogeneity of the scores of mathematical reasoning in groups is determined by Homogeneity of Variance. Analysis shows that the scores of reasoning tests are normally distributed and homogeneous.

EQ Test

Emotional Quotient (EQ) was assessed using a questionnaire with a scale developed by Goleman. Questionnaire consists of 32 items with 5 aspects of EQ that are self awareness, self management, motivation, empathy, and build relationships (teamwork). Questionnaire EQ validated by content validation and conducted factor and reliability analysis with Cronbach alpha ($\alpha = .761$). The validity and reliability of the emotional intelligence scale is acceptable. Normality of EQ score with the Kolmogorov-Smirnov Sample test, whereas the homogeneity of emotional intelligence scores in the group is determined by Homogeneity of Variance. Analysis shows that *Emotional Quotient (EQ)* scores are normally distributed and homogeneous.

Data Collection

Research was conducted in several junior high schools. Participants were asked to take an EQ test and assess mathematical reasoning with the TIMSS model. Students are given EQ questionnaires on different days.

Data Analysis

Test and questionnaire data were analyzed with descriptive statistics for normality test. Furthermore, the students' mathematical reasoning and EQ scores are converted based on the following criteria.

TABLE 1. Students' Mathematical Reasoning and EQ Criteria

No	Interval	Criteria
1	$X > Mi + 1,5Si$	Very high
2	$Mi + 0,5Si < X \leq Mi + 1,5Si$	High
3	$Mi - 0,5Si < X \leq Mi + 0,5Si$	Medium
4	$Mi - 1,5Si < X \leq Mi - 0,5Si$	Low
5	$X \leq Mi - 1,5Si$	Very Low

With M_i = average ideal score = $\frac{1}{2}$ (ideal maximum score + ideal minimum score), S_i = ideal standard deviation = $\frac{1}{6}$ (ideal maximum score - ideal minimum score), dan X = empirical score. To know the relation between mathematical reasoning and EQ students using Pearson product moment correlation applied to data and analysis of crosstab (cross tabulation) between variabel.

RESULT AND DISCUSSION

The data obtained in this research are test result about TIMSS model of reasoning type and the result of questionnaire of Emotional Quotient (EQ) of students. Data were analyzed to describe students' mathematical reasoning abilities grouped according to student EQ level.

Student's Reasoning Mathetaics Ability

The average score of respondents for mathematical reasoning ability in this study was 51.00. Table 2 presents the descriptive statistics of the students' mathematical reasoning instruments used in this study.

TABLE 2. Descriptive Statistics of Mathematical Reasoning Ability

N	Maximum	Minimum	Average	Standar Deviation
312	100	0	38,67	27,33

Emotional Quotient (EQ) Student

According to [14] scores of 30 items can be summarized to provide overall dispositional scores for a student with a range of 30-150. A score < 60 will show very low disposition; 60 < score ≤ 80 low disposition; 80 < score ≤ 100 moderate, 100 < X ≤ 120 high, and score over 120 very high disposition. A useful strategy should also include checking the subscale score.

The average score of respondents for emotional intelligence in this study was 91.77 with a standard deviation of 12.45.

The level of significance is set at 0.05. Table 3 presents the descriptive statistics of two EQ instruments used in this study.

TABLE 3. Descriptive Statistics of EQ

N	Maximum	Minimum	Average	Standar Deviation
312	135	57	91,64	15,59

Therefore, against the full emotional intelligence score of 150, the students of grade VIII in this study are considered to have a category of emotional intelligence level that is being.

The Mathematical and Emotional Quotient (EQ) Student's reasoning abilities

To investigate the relationship between students' mathematical reasoning abilities and their EQ Pearson used product-moment correlations. The correlation results revealed that there was a significant correlation between mathematical reasoning abilities and student EQ and their value of mathematical reasoning ability ($r = 0.695$, $p < 0.05$).

It also found that there is a significant relationship between students' mathematical reasoning abilities and the five components that make up the total EQ tests as follows: mathematical reasoning and 1) Self-Awareness ($r = 0.547$, $p < .05$), 2) Self Management ($r = 0.512$, $p < .05$), 3) Motivation ($r = 0.507$, $p < .05$), 4) Empathy ($r = 0.595$, $p < .05$), 5) Build Relationships ($r = 0.493$), $p < .05$) (see Table 4).

TABLE 4. Correlation between mathematical reasoning and EQ components

	Matematics Reasoning	Sig
Self Awareness	0,547	0.000
Self Management	0,512	0.000
Motivation	0,507	0,000
Empathy	0,595	0.000
Relationship Management	0,493	0.000

This study discusses the relationship between mathematical reasoning ability and Emotional Quotient (EQ) students. The result justifies the dynamic interaction between the two variables. At first glance, this may seem to contradict traditional beliefs that assume an increase in emotional ability impedes the development of cognitive ability and thinking. It may also appear inconsistent with prevailing stereotypes and misconceptions that show that thoughts and emotions conflict with each other or function independently. This study, however, revealed EQ students tend to better equip them with reasoning ability. As discussed earlier, a theoretical disagreement body that appears in the literature is set to show the interrelationships between the cognitive and affective dimensions, which are conducive to effective learning. Meyers (1986), Brookfield (1987), and Paul (1987) were among the first scholars to argue that mind and emotion are inextricably bound (as quoted in [15]).

In addition, [13] research states that personal emotions have a decisive role in critical thinking, and that information about the personality and individual emotional state must be obtained before instructing him how to think critically. This suggests that critical thinking is unable to successfully lead our beliefs and actions unless critical thinking continuously assesses not only our cognitive abilities, but also our feelings or emotions. The key to this discussion is in maximizing high-level thinking skills (such as reasoning) requiring not only cognitive abilities but also the drive or desire to do so. Indeed, one must feel the importance of doing something and committing to it. From the perspective of common sense, in the absence of strong emotional competence, ideas and circumstances tend to be responded by direct affective reactions, which may be vulnerable to error. This can create an orientation in the minds of individuals who are difficult to modify and potentially influence subsequent reasoning, judgment, and decisions while regulation and manipulation of emotional states can pave the way for making reflective and purposeful judgments and decisions.

At this time the theory of emotional intelligence began to develop because it is needed and considered in the face of developments that occur in this day and age. Emotional intelligence is needed to support a person in order to use his mind based on reason. In addition to good thinking skills such as good reasoning, an individual needs to be equipped with a good EQ as well. Emotional intelligence also supports one's success. In accordance with the opinion [16] which states that in supporting the success of a person the influence of IQ is only 20% alone, while 80% influenced by Emotional Quotient (EQ). Thus, if a person has both may be able to produce a very good thing as well.

Some research results in the field of mathematics show that emotional intelligence affects the ability of students to think and learn mathematics. One study by [17] shows that students with high emotional intelligence and high mathematical abilities are able to resolve the problem given correctly and vice versa students with moderate and low intelligence and mediocre and low math skills in solving the given problem still making a mistake.

The relationship of mathematical reasoning ability to EQ component has also been seen in the research results. The ability of mathematical reasoning and self-awareness is one's ability to recognize what he feels, to understand one's emotional response to events and to recognize how emotions affect one's behavior and performance [11]. This shows that the level of ability to recognize the emotions of the self affects the students' mathematical reasoning abilities.

The ability of mathematical reasoning and self management is the ability to stay focused and think clearly even when experiencing strong emotions [11]. This shows the degree of self-restraint of strong emotions affecting students' mathematical reasoning abilities.

The ability of mathematical reasoning and motivation is the ability to use the deepest emotions to move and guide toward the goal. This ability allows one to take the initiative and persist in the face of obstacles and setbacks [11]. This suggests that the degree of not giving up on a problem affects the students' mathematical reasoning abilities.

The ability of mathematical reasoning and empathy is the ability to feel, understand, and respond to the feelings of others [11]. In addition, as well as for the ability of mathematical reasoning and fostering relationships are the

ability to manage, influence and inspire the emotions of others [11]. This shows that the level of social maturity of students creates the ability of reasoning.

CONCLUSION

This study resulted in the conclusion that the mathematical reasoning ability of junior high school students of class VIII in Bengkulu and Emotional Quotient (EQ) they have significant relationship. The conclusions and recommendations derived from this study encourage educators to take advantage of this relationship by providing students with experience to know their EQ levels. Thus, there is an opportunity to improve their mathematical reasoning abilities as well.

Teachers are encouraged to develop and integrate EQ-related skills in the classroom. In addition, teachers are advised to develop and integrate between an EQ component specifically to another intellectual ability. They are recommended to determine effective pathways for developing self-awareness or student motivation.

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