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ANALYSIS OF STUDENTS' MATHEMATICAL LOGICAL THINKING IN TERMS OF EMOTIONAL INTELLIGENCE

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ABSTRAK

Kecerdasan emosional dan berpikir logis matematis merupakan dua aspek penting dalam pembelajaran matematika. Penelitian kualitatif ini bertujuan untuk menganalisis kemampuan berpikir logis matematis siswa trigonometri ditinjau dari kecerdasan emosional. Data dikumpulkan menggunakan skala kecerdasan emosional, tes berpikir logis matematis, dan pedoman wawancara. Partisipan penelitian ini adalah siswa kelas XI IPA-2 sebuah madrasah aliyah di Kabupaten Bantul. Kelas tersebut dipilih karena berdasarkan informasi yang diperoleh dari guru, siswa di kelas tersebut terdiri dari siswa dengan berbagai karakteristik kemapuan matematis. Pengumpulan data diawali dengan pengambilan data skala kecerdasan emosional, dilanjutkan dengan memberikan tes, dan setelahnya dilakukan pengambilan data melalui wawancara. Adapun tahap analisis data pada penelitian ini adalah reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa terdapat perbedaan kemampuan berpikir logis matematis berdasarkan tingkat kecerdasan emosional siswa. Perbedaan yang dimaksud adalah dua atau lebih siswa yang masing-masing berasal dari tingkat kecerdasan emosional yang berbeda memiliki perbedaan pula dalam kemampuan berpikir logis matematis. Penelitian ini dapat dijadikan sebagai salah satu referensi untuk penelitian berikutnya yang serupa. Selain itu apabila guru hendak memilih strategi pembelajaran matematika untuk meningkatkan kemampuan berpikir logis matematis berdasarkan tingkat kecerdasan emosional siswa, maka penelitian ini juga dapat dijadikan sebagai referensi.
Kata Kunci: Berpikir logis matematis, Kecerdasan emosional, Perbandingan trigonometri.

ABSTRACT

Emotional intelligence and mathematical logical thinking are two important aspects in learning mathematics. This qualitative study aims to analyze students' mathematical logical thinking in terms of emotional intelligence. Data were collected using emotional intelligence scale, mathematical logical thinking test, and interview guidelines. The participants of this study were students of class XI-IPA 2 at a madrasah aliyah in Bantul Regency. The class was chosen because based on the information obtained from the teacher, the students in the class consisted of students with various characteristics of mathematical ability. Data collection begins with taking data on the emotional intelligence scale, followed by giving tests, and after that data collection through interviews. The stages of data analysis in this study are data reduction, data presentation, and drawing conclusions. The results showed that there were differences in the ability to think logically mathematically based on the level of students' emotional intelligence. The difference in question is that two or more students, each of which comes from different levels of emotional intelligence, have differences in their ability to think logically and mathematically. This research can be used as a reference for the next similar research. In addition, if the teacher wants to choose a mathematics learning strategy to improve mathematical logical thinking

skills based on the level of students' emotional intelligence, this research can also be used as a reference.
Keywords: Mathematical logical thinking, Emotional intelligence, Trigonometric ratio

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INTRODUCTION

In the learning process in schools, the suitability between student learning outcomes and learning objectives is the ultimate goal of the process. Regarding learning outcomes, there are factors that also determine student learning outcomes. These factors are internal factors (from within the students themselves) such as emotional intelligence and talent as well as external factors (from outside students) such as the family environment and school environment (Hapnita et al., 2018; Sitorus, 2017). Of these several factors, there is one interesting factor for further review, namely emotional intelligence. Emotional intelligence is a concept that has received attention from researchers including psychologists recently. Interest in emotional intelligence research was seen after Daniel Goleman published his monumental work in 1995 (Nor et al., 2016). According to Goleman, emotional intelligence is the ability to motivate oneself and survive in the face of unpleasant situations, control impulses and delay gratification (not easily satisfied), regulate moods and keep thinking skills from being stifled by pressure, and to be able to empathize and hope (Goleman, 1995). The urgency of emotional intelligence cannot be underestimated. Emotional intelligence is also a determinant of one's success in addition to intellectual intelligence (Yelkikalan et al., 2014). Emotional intelligence is also needed to achieve a desired goal, including learning (Sherry, 2016). This is in accordance with the opinion that emotional intelligence is closely related to learning achievement. Not without reason, with emotional intelligence students can know themselves, their feelings, emotions, thoughts and characteristics to be able to control emotions, manage stress and build optimism (Setiawati, 2016). Therefore we need lessons that can hone students' emotional intelligence. Mathematics is a subject that requires emotional intelligence. Through various mathematical problems given in learning, students are given space to solve these problems while still controlling their emotions (Farhan & Alfin, 2019). In addition, there are results from previous studies which show that there is a positive relationship between emotional intelligence and mathematics learning outcomes (Shafiee et al., 2016).

Based on this definition, Goleman tries to describe emotional intelligence into several dimensions. There are 4 dimensions of emotional intelligence, namely self-awareness, self-management, social awareness, and relationship management. Self-awareness is defined as a deep understanding of a person's emotions including their strengths and weaknesses with indicators of emotional self-awareness, accurate self-assessment, and self-confidence.

Meanwhile, self-management is an encouragement to achieve a goal with indicators of emotional self-control, transparency, adaptability, achievement, initiative, and optimism. The next dimension is Social-awareness which is defined as the ability to empathize (understand the feelings of others) with indicators of empathy, organizational awareness, and service. Relationship management as the last dimension of emotional intelligence is defined as making friends for a purpose or can also be interpreted as moving others to achieve the desired goals with indicators of inspirational leadership, influence, developing others, change catalysts, conflict management, and teamwork and collaboration (Goleman et al., 2004).

In learning mathematics, one of the skills taught is mathematical logical thinking (Ratnasari et al., 2022). The purpose of logical thinking in learning mathematics is so that students are able to develop mastery of mathematical concepts and understand and develop mathematical concepts (Kadarisma, 2016). Mathematical logical thinking departs from the concept of multiple intelligences proposed by Howard Gardner, namely mathematical logical intelligence. Gardner explains that mathematical logical intelligence is an individual's ability to use numbers and logic as well as effectively and well (Armstrong, 2009). The emphasis of logical thinking is on the ability to draw the right conclusions without violating the established signs (logic) (Novaliyosi et al., 2019). Some prominent figures with prominent mathematical logical intelligence include Bill Gates and Stephen Hawking (Hoerr, 2000). Based on this explanation, it can be seen that there are 3 characteristics of logical thinking, namely thinking in a coherent way, arguing, and finding solutions. These three things are then used by Ni'matus (Andriawan & Budiarto, 2014) as an indicator of mathematical logical thinking, namely thinking impairment, ability to argue, and drawing conclusions. According to him, thinking coherence is a person's ability to be able to mention all the information that is known and asked in the problem and is able to provide an overview of problem solving. The ability to argue is a person's ability to be able to provide logical arguments for each step taken in order to find solutions to the problems given. The last indicator of logical thinking is drawing conclusions. Drawing conclusions is defined as a person's ability to draw conclusions as a solution to a problem.

The existence of logical thinking in learning mathematics is very important. Students with mathematical logical thinking skills will find it easier to deal with non-routine questions or problems (Zaman et al., 2017). In addition, mathematical logical thinking will train students to have a bold, assertive, and objective attitude (Ab et al., 2019). Based on this description, this research wants to study more about logical thinking, mathematical and emotional intelligence. The purpose of this study was to analyze the ability to think logically mathematically in terms of emotional intelligence. This research is important to do considering mathematical logical thinking and emotional intelligence are two important things in learning mathematics. Even previous research shows that there is a positive influence given both emotional and logical thinking on mathematics learning (Mislianti et al., 2022; Sari, 2019). With this research, it can later be used as a reference for similar subsequent studies and can be used as a reference for teachers in determining appropriate mathematics learning strategies to improve students' mathematical logical thinking skills when viewed from the point of view of emotional intelligence.

METHODS

Research design and data collection

This research is a descriptive qualitative research. Qualitative research has a goal to understand the meaning of a problem both from individuals and groups (Creswell, 2014). The purpose of this study was to analyze the mathematical logical thinking ability of trigonometric students in terms of emotional intelligence. The subjects of this study were students of class XI-IPA 2 of a madrasah aliyah in Bantul Regency. The choice of the class as the subject of the study was based on the teacher's information that the students in that class had a greater diversity of mathematical abilities when compared to other classes.

The tools used by researchers as data collectors are emotional intelligence scale, mathematical logical thinking test, and interview guidelines. The scale sheet is used to measure students' emotional intelligence. The scale contains 36 statement items. The preparation of the scale instrument refers to Goleman's 4 dimensions of emotional intelligence, namely self-awareness, self-management, social awareness, and relationship management with 18 indicators. The scale instrument has been validated and after being revised as necessary, the scale instrument is declared suitable for use. Before being used, the scale instrument will be validated by experts. Experts consist of psychologists and experts in the field of mathematics education who also specialize in the field of psychology. The validation results show that there are several improvements that must be made before the instrument is carried out, both in terms of grammar and the suitability of the statement with the indicators to be measured. After being revised and resubmitted, the experts stated that the scale instrument could be used. The example of an emotional intelligence scale statement for each dimension is shown in Table 1.

Table 1. Example of Emotional Intelligence Scale Statement Items

Dimension	Statement
Self-awareness	• I know something is bothering me. • I find it difficult to find a way of learning that suits my characteristics.
Self-management	• I slam things around when I'm angry. • I easily adapt to various changes in life
Social Awareness	• I take the time to help a friend. • Only the main management is obliged to understand the organization's program.
Relationship Management	• Other people can believe in my ideas. • I hate people who are hated by my friends.

Later, each student's emotional intelligence scale score will be classified into 1 of 3 categories, namely high, medium, or low. The division is done to facilitate the selection of interview subjects so that the results obtained are specific for certain categories. The categorization of emotional intelligence levels is presented in Table 2 where x is the student's acquisition score, $\bar{x}$ is the average, and SD is the standard deviation (Lestari & Yudhanegara, 2015).

Table 2. Guidelines for Categorizing Emotional Intelligence Scores

Interval	Category
$x \geq \bar{x} + SD$	High
$\bar{x} - SD < x < \bar{x} + SD$	Medium
$x = 0$	Low

After students are given a scale, then students are given a test. The test is intended to determine the students. The test consists of 4 questions. All of the questions are in the form of descriptions. This study chose the form of description questions for the test because the form of this question allows students to be able to express their ideas optimally in written form in order to obtain answers to the problems given (Pratama et al., 2019). If there is an error in the final result, the corrector can easily find or trace the cause. The data obtained were then classified into high, medium, or low categories. Students who have high emotional intelligence, for example, are then classified again based on their test results.

The preparation of the questions is done based on the logical mathematical thinking indicators proposed by Ni'matus (Andriawan & Budiarto, 2014). The coherence of thinking means that students are able to express any information that is known and asked and can express in general the sequence in solving problems, the ability to argue is that students are able to provide logical arguments for each step of work carried out until conclusions are obtained, while drawing conclusions are students able to give the right conclusion is the answer to the question. The preparation of items refers to the basic competencies that have been determined, although not all parts of trigonometry are included in the items. The part of trigonometric material reviewed is limited to triginonometric ratio. This is based on two considerations. The first consideration is that trigonometric ratio are the basis that students must master as a provision to study other parts of trigonometry such as the sine and cosine rules. The second consideration is that apart from trigonometric material, trigonometric ratio are also an important asset for students when studying other mathematical materials such as three dimensions (Kepa, 2019).

After the test instrument has been compiled, the validation process is carried out. Validation was carried out by mathematics education experts and mathematics teachers. Based on the validation process, it is known that there are several improvements that need to be made before the instrument can be used. The results of the improvements were submitted back to the experts and the experts also stated that the improved instruments had been used. If the data in the form of test scores have been obtained, then the test scores of each subject are divided into three categories, namely high, medium, or low. The formula used to determine the value interval for each category is the same as the formula for the results of the scale as shown in Table 2. The division of each test score into a category aims to facilitate the selection of interview subjects and the results obtained are specific to a particular category. The an example of a mathematical logical thinking problem is shown in Tabel 3.

Table 3. Example of Mathematical Logical Thinking Test Items

Number	Statement
1	Given a right triangle ABC with a right angle at B. If $\tan C = \frac{3}{4}$, then investigate and explain (If true why? Or if false why?): a. Is $\sin C = \frac{4}{3}$ correct? b. Is $\cos A \,.\, \csc C = 1$ correct?
2	The PQR triangle has coordinates $P(-4,7)$, $Q(-4,-1)$, and $R(2,-1)$. Determine the values of $\sec R$, $\csc P$, and $\cot R$ in their simplest form!

After the scale and test are given, the results will be classified again as in Table 4. Classification is intended to categorize students based on the results of the scale and the test at once. These results will then be used as a provision for researchers in determining the subject of the interview. The interviewed students will represent one category of emotional intelligence and one category of mathematical logical thinking. The selection of interview subjects based on a category of emotional intelligence and mathematical logical thinking was carried out to be able to find out more about the subject's ability to think logically and mathematically. Of course, the selection of interview subjects was carried out based on the consideration that the subject in question had the most complete answers for the logical-mathematical thinking test compared to other students in the same category of emotional intelligence and mathematical logical thinking as was done by Kholidah (2020). In addition, students who were selected as interview subjects had good communication skills and the information was obtained from the teacher. Interviews were conducted to obtain more precise and in-depth data regarding students' ability to think logically mathematically using interview guidelines.

Table 4. Classification of Emotional Intelligence and Mathematical Logical Thinking

Emotional intelligence category	Mathematical logical thinking category	Subject code
High	High	ETLT
	Medium	ETLS
	Low	ETLR
Medium	High	ESLT
	Medium	ESLS
	Low	ESLR
Low	High	ERLT
	Medium	ERLS
	Low	ERLR

After the classification, one subject will be selected which will represent a category of emotional intelligence and mathematical logical thinking. The selection was based on the consideration that the subject had the most complete answer and had good communication skills based on the teacher's information. It should be stated that before the interview was conducted, the researcher ensured the subject's understanding of the definition of trigonometric ratio. The result of the 6 subjects, only ESLT understood it and the other admitted that they did not understand. On this basis, the researcher tries to provide an explanation regarding the definition

of trigonometric ratio as necessary. After being given this explanation, all subjects other than the ESLT asked for permission to rework the given test. Meanwhile, ESLT only asks for permission to re-examine the results of its work and try to make improvements as necessary. Therefore, the results of the interviews given in this study were based on the results of retests or improvements made by each subject.

The interview guide that was compiled refers to the indicators of mathematical logical thinking ability as described previously, namely the sequence of thinking, the ability to argue, and drawing conclusions. The interview guide consisted of 10 questions consisting of 3 items for indicators of thinking continuity, 5 items for argumentation ability, and 2 items for conclusions drawn indicators. The purpose of giving at least two questions for each indicator of mathematical logical thinking is to obtain complete and in-depth information about how students think and do tests. The interview guide instrument has also gone through a validation process and the results show that the instrument is feasible to use. The validation results show that there are parts that can be improved. After corrections were made and resubmitted, the experts agreed on the interview guidelines to be used. The examples of questions in the interview guide is shown in Table 5.

Table 5. Example of Intervies Questions

Indicator	Question
Coherence of Thinking	What information is known from this question?
Arguing Ability	What are your steps in solving this problem?
Drawing Conclusions	Based on the completion steps you have made, what conclusions can you draw?

To analyze the data, this study uses the analytical technique proposed by Miles and Huberman, starting from reduction, followed by data presentation, to the final stage, namely drawing conclusions (Miles & Huberman, 1994). The data analysis stage begins with data reduction. Data reduction was carried out with the aim of obtaining at least two categories of data, namely important data and unimportant data. Data that is considered important will be retained, while data that is not important will be discarded. The data from the scale and test results for each subject were classified into 3 categories, namely high, medium, and low. After that, the interview subjects were selected. Students with the most complete test answers and have good communication skills based on teacher information will potentially be selected as interview subjects representing a certain category of emotional intelligence and logical mathematical thinking. The results of the interview will also be selected. Irrelevant information will be discarded and relevant information retained. If there is insufficient information, the researcher asks again the interview subject.

The next analysis process is data presentation. The research data presented comes from scales, tests, and interviews that have been conducted. Data is presented in the form of narration and tables. The final stage of the data analysis process according to Miles and Huberman is drawing conclusions. Therefore, conclusions are drawn after the data reduction and presentation process is complete. Drawing conclusions based on the data obtained both the results of the scale, tests, and interviews. To ensure the validity of the data, this study uses

triangulation. The chosen triangulation is the data source by comparing data from several data sources (Azizah, 2019). Triangulation is done by comparing data obtained from scales, tests, and interviews.

RESULT AND DISCUSSION

The results of the classification are presented in Table 6.

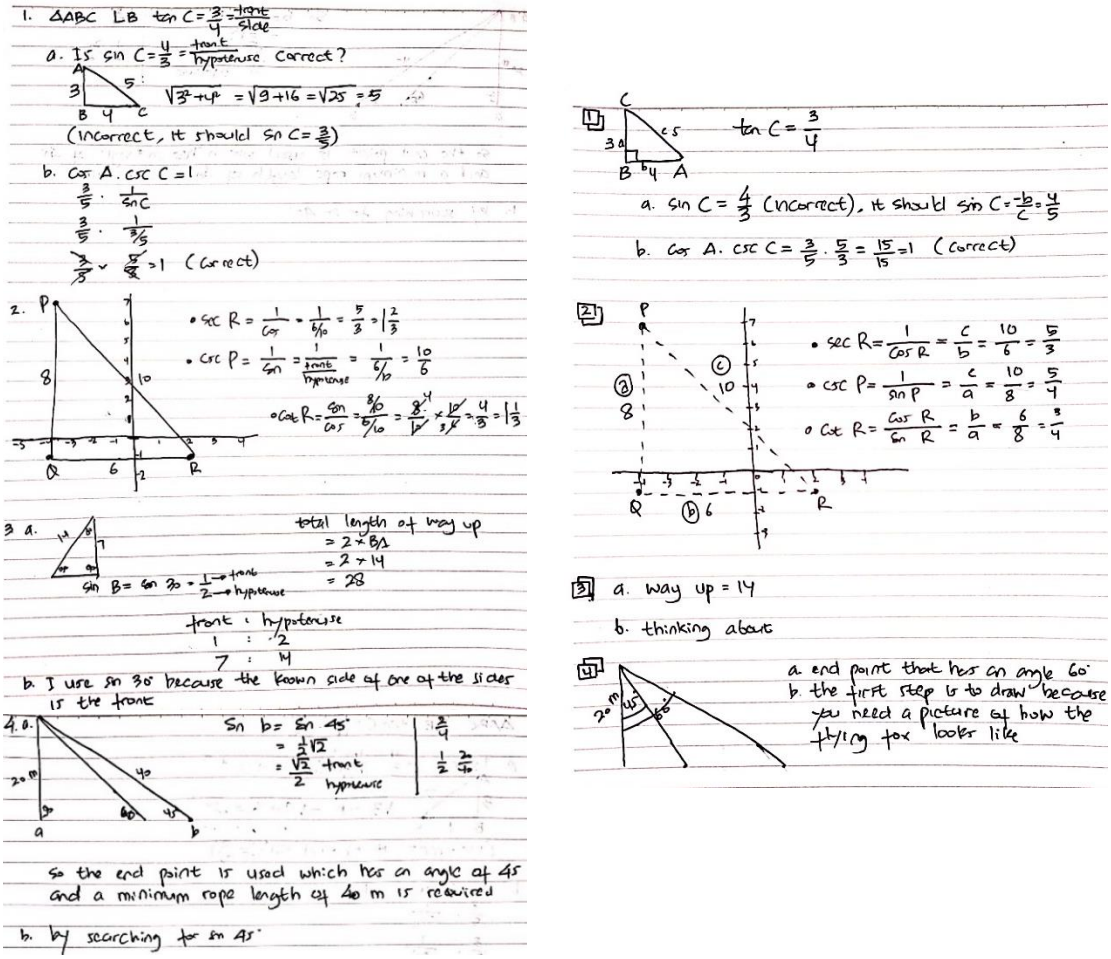
Table 6. Results of Classification of Emotional Intelligence and Mathematical Logical Thinking

Emotional intelligence category	Mathematical logical thinking category	Subject code	Total students
High	High	ETLT	0
	Medium	ETLS	6
	Low	ETLR	0
Medium	High	ESLT	4
	Medium	ESLS	12
	Low	ESLR	3
Low	High	ERLT	1
	Medium	ERLS	4
	Low	ERLR	0
Total			30

Thus, the interview subjects of this study were SSN representing ETLS, RTN representing ESLT, NGH representing ESLS, TRT representing ESLR, HMN representing ERLT, and FHR representing ERLS. SSN, RTN, NGH, TRT, HMN, and FHR are the initials of the interview subject's name.

Subjects with high mathematical logical thinking

The students with high mathematics logical thinking's answer is shown in Figure 1. Based on the test results in Figure 1 (a) and (b), the following will be presented an analysis of students' ability to think logically mathematically according to the indicators given. First for ESLT students' mathematical logical thinking are 1) able to write down most of the information that is known correctly, 2) able to write down a small part of the information asked correctly, 3) able to provide a clear picture for the steps for solving all questions, 4) able to provide logical arguments in most of the problem solving steps, and 5) the conclusions given are mostly correct. Second, ERLT has the ability to think logically mathematically, namely 1) being able to write down most of the information that is known correctly, 2) not writing down the information asked at all, 3) being able to provide a clear picture for the steps in solving most of the questions, 4) being able to provide arguments. logically in a small part of the problem-solving steps, and 5) the conclusions given are a small part of the correct value.



(a) (b)

Figure 1. (a) ESLT Test Results, (b) ERLT Test Results

After the analysis of the test results is carried out, then an analysis of the interview results is carried out. The transcript snippet of the researcher's interview with the ESLT and ERLT is shown in Table 7.

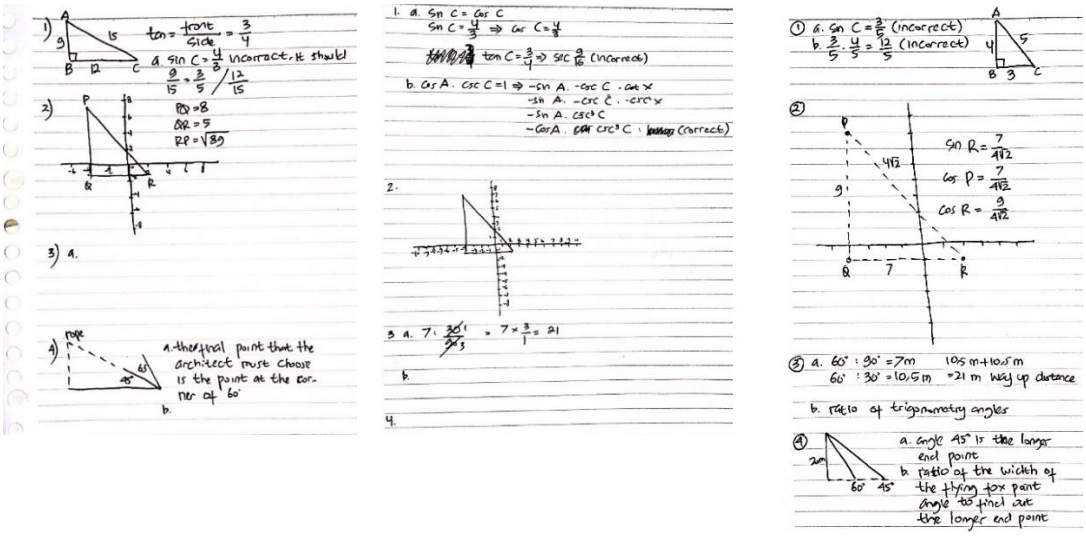
Table 7. ESLT and ERLT Interview Transcript Snippets

		ESLT	ERLT
Q	:	*What method did you use to solve this problem?*	*What method did you use to solve this problem?*
A	:	*I use a ratio of sec, csc, cot sir.*	*I used a comparison of sec R, csc P, and cot R*
Q	:	*Why?*	*Why?*
A	:	*Because that's what was asked.*	*Because that's what was asked.*
Q	:	*Furthermore, have you come to a conclusion?*	*Have you come to a conclusion?*
A	:	*Already sir.*	*Already sir.*
Q	:	*What conclusions can you draw?*	*What conclusions can you draw?*
A	:	*The value of* $sec\ R = 1\frac{2}{3}$, $csc\ P = 1\frac{2}{3}$, $cot\ P = \frac{3}{4}$.	*Value of* $sec\ R = \frac{5}{3}$, $csc\ P = \frac{5}{3}$, $cot\ R = \frac{3}{4}$.

For ESLT the ability to think logically mathematically is 1) able to convey most of the information that is known correctly, 2) able to convey most of the information asked correctly, 3) able to provide a clear picture for the steps for solving all questions, 4) able to provide logical arguments in most of the problem solving steps, and 5) the conclusions given are mostly correct. As for ERLT, the ability to think logically mathematically is 1) able to convey all known information correctly, 2) able to convey most of the information asked correctly, 3) able to provide a clear picture for the steps for solving all questions, 4) able to provide logical arguments in all steps of problem solving, and 5) the conclusions given are mostly correct. Based on this analysis, it was found that ESLT's mathematical logical thinking is better than ERLT.

Subjects with medium mathematical logical thinking

The students with medium mathematics logical thinking's answer is shown in Figure 2. According to Figure 2 (a), (b), and (c), the following will describe the mathematical logical thinking of each subject. ETLS subjects have the ability to think logically mathematically, namely 1) able to write down some of the information that is known correctly, 2) not writing down the information asked at all, 3) being able to provide a clear picture for the steps to solve some of the questions, 4) unable to provide logical arguments in all steps for solving the problem, and 5) the conclusion given is a small part of the value is correct. Furthermore, for ESLS subjects, their mathematical logical thinking are 1) not writing down any known information, 2) not writing down at all the information asked, 3) not being able to provide a clear picture for the steps for solving all questions, 4) not being able to provide logical arguments. in all steps of solving the problem, and 5) the conclusion given is a small part of the correct value. As for the ERLS subject, the ability to think logically mathematically is 1) able to write down most of the information that is known correctly, 2) not writing down the information asked at all, 3) being able to provide a clear picture for the steps in solving most of the questions, 4) being able to provide arguments logically in a small number of steps to solve the problem, and 5) the conclusion given is a small part of the correct value.



(a) (b) (c)

Figure 2. (a) ETLS Test Results, (b) ESLS Test Results, (c) ERLS Test Results

After the analysis of test results is presented, Table 8 will describe the analysis of interview results for each subject. The following is transcript snippet of the researcher's interview with the ETLS, ESLS, and ERLS. According to the results of interviews, ETLS mathematical logical thinking are 1) able to convey most of the information that is known correctly, 2) able to convey most of the information asked correctly, 3) able to provide a clear picture for the steps to solve all questions, 4) able to provide logical arguments in all steps of problem solving, and 5) the conclusions given are mostly correct. The ESLS mathematical logical thinking are 1) able to convey all known information correctly, 2) able to convey all the information asked correctly, 3) able to provide a clear picture for the steps for solving all questions, 4) able to provide logical arguments in all cases. steps to solve the problem, and 5) the conclusions given are mostly correct. For ERLS subjects have the ability to think logically mathematically, namely 1) able to convey most of the information that is known correctly, 2) able to convey most of the information asked correctly, 3) able to provide a clear picture of the steps for solving most of the questions, 4) able to provide logical arguments in most of the problem solving steps, and 5) the conclusions given are mostly correct.

Table 8. ETLS, ESLS, and ERLS Interview Transcript Snippets

		ETLS	ESLS	ERLS
Q	:	*How do you solve that problem?*	*Try now to briefly describe your steps in solving this problem!*	*How do you solve that problem?*
A	:	*First, I drew the triangle, sir, then I looked for* $\tan C = \frac{3}{4}$ *and then I calculated the values of* $\sin C$, $\cos A$, *and* $\csc C$.	*I determined the side of the triangle from* $\tan C = \frac{3}{4}$ *by the ratio of the front/side, find the hypotenuse, and prove it is true or not.*	*First, I made the triangle and determined the location of the right angles, looked for* $\tan C$, *and the hypotenuse of the triangle. If the* $\tan$ *is front/side.*
Q	:	*Does that mean that the first step you take to solve this problem is to draw the triangle first?*	*It means that your first step is to determine the side of the triangle from* $\tan C = \frac{3}{4}$ *with the ratio of the front/side, is that right?*	*What was the first step you took to solve the problem?*
A	:	*You're right.*	*Right.*	*First, I draw a right triangle, sir, because the problem is that it is known that it is a triangle.*
Q	:	*Why?*	*Why?*	*How do you solve that problem?*
A	:	*To make it easier for you to do it.*	*To find the hypotenuse.*	*First, I made the triangle and determined the location of the right angles, looked for* $\tan C$, *and the hypotenuse of the triangle. If the* $\tan$ *is front/side.*

Based on these results, it can be concluded that subjects with high emotional intelligence have better mathematical logical thinking than subjects with moderate emotional intelligence for the same category of mathematical logical thinking, namely moderate. Subjects with low emotional intelligence turned out to have better mathematical logical thinking than subjects with high or moderate emotional intelligence. Researchers are trying to find out these findings.

According to the results of the interview, when the test data will be taken, subjects with low emotional intelligence make preparations. The preparation is the subject of learning and re-understanding trigonometric ratio. Other subjects are subjects with high emotional intelligence and are not preparing for the test.

If the results of interviews about student preparation are tried to be brought into the context of emotional intelligence, then it will lead to the dimension of self-management. Self-management is defined as an encouragement to achieve a goal (Goleman et al., 2004). When given the information that a test will be conducted, the subject with low emotional intelligence makes an effort to learn and understand again about trigonometric ratio that have been received in class X. This finding is in line with the opinion that emotional intelligence is not innate but emotional intelligence is something that can be learned and developed (Cavaness et al., 2020). Even the Islamic perspective views that a person's emotional intelligence can be trained since being in the mother's womb (Sulistiyo, 2017).

Subjects with low mathematical logical thinking

The students with medium mathematics logical thinking's answer is shown in Figure 3. The results presented are only for ESLR subjects considering that students who have a low test category are all in the medium emotional intelligence category.

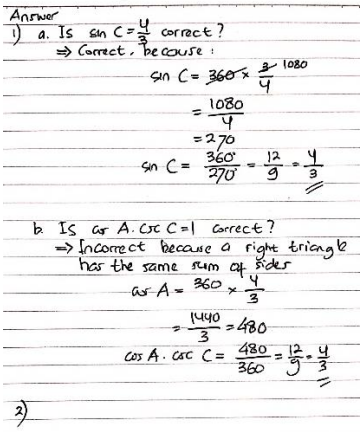


Figure 3. ESLR Test Results

For the results of the ESLR test, they have the ability to think logically mathematically, namely 1) being able to write down a small part of the information that is known correctly, 2) being able to write down a small part of the information asked correctly, 3) not being able to provide a clear picture for the steps for solving all questions, 4) unable to provide logical arguments in all steps of problem solving, and 5) no conclusions are given. The results of the interview show that ESLR has the ability to think logically mathematically, namely 1) able to convey all known

information correctly, 2) able to convey most of the information asked correctly, 3) able to provide a clear picture for the steps for solving all questions, 4) able to provide logical arguments in all steps of problem solving, and 5) the conclusions given are mostly correct. The transcript snippet of the researcher's interview with the ESLR is presented in Table 9.

Table 9. ESLR Interview Transcript Snippets

		ESLR
R	:	*Number 4 what is known?*
ESLR	:	*The position of the end of the rope is* $20\ m$ *and there are 2 end points with angles of* $45°$ *and* $°$.
R	:	*What was asked?*
ESLR	:	*The end point that the architect must choose and the steps used in solving the problem.*
R	:	*Try now to briefly explain your steps in solving this problem!*
ESLR	:	*I draw first and then write the length of the end of the rope, determine 2 end points, and choose the longest point.*

From the analysis of the results of both tests and interviews above, it shows that emotional intelligence and mathematical logical thinking are two important things in learning mathematics. Mathematical logical thinking is closely related to problem solving so that one of the Problem Based Learning learning methods for the sub-subject of trigonometric ratio can be used as an alternative for teachers' efforts to boost these abilities (Fitriyah et al., 2019). Not only limited to the scope of mathematics, logical thinking will also help students solve various problems in other scientific fields as well as in everyday life (Jatri, 2013). The emotional intelligence will help students in learning mathematics. Such a statement is in line with a statement that mathematics is a subject that requires emotional intelligence in other words to learn mathematics students must be able to manage their emotions well (Maharani, 2014; Setyawan & Simbolon, 2018). In this case the teacher also has a role in the growth and development of students' emotional intelligence (Idrus et al., 2020). Therefore, it is important to pay attention to the selection of learning models that can train intelligence. Moreover, emotional intelligence will be able to develop if it is trained continuously (Setyoko et al., 2019). An alternative learning model used by teachers to train students' emotional intelligence is cooperative learning (Istiqomah, 2017).

CONCLUSION

The conclusion of this study is that there are differences in students' mathematical logical thinking in the sub-topic of trigonometric ratio based on students' emotional intelligence. Subjects who have the same category of mathematical logical thinking as many as 2 students, namely high but have different emotional intelligence, namely moderate (ESLT) and low (ERLT) have different abilities in terms of mathematical logical thinking. ESLT has better mathematical logical thinking than ERLT.

Furthermore, for subjects with the same mathematical logical thinking category, 3 students, namely moderate but have different emotional intelligence, namely high (ETLS), moderate (ESLS), and low (ERLS) have different abilities in mathematical logical thinking. ETLS

has better mathematical logical thinking than ESLS. In this case, the research found that ERLS has the ability to think logically and mathematically more than ETLS and ESLS. Facts obtained based on interviews, subjects with low emotional intelligence made preparations by studying before the test was carried out. As for the subjects with the category of low mathematical logical thinking, they cannot be compared because the three subjects in that category are all in one category of moderate emotional intelligence (ESLR).

Considering that this research is a research that examines the ability to think logically mathematically and emotional intelligence is still rarely found, the next research as a follow-up is interesting to do. One of the further topics that can be studied as an interesting thing to research is the relationship between emotional intelligence and the ability to think logically and mathematically. Thus, this research can be used as a reference.

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