

Analysis of Mathematical Conceptual Understanding Viewed from Emotional Intelligence

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ARTICLE INFO	ABSTRACT
Published Online: 04 July 2026	Conceptual understanding forms the basis for pupils to make connections and solve various mathematical problems. However many pupils still experience difficulties a factor influenced by emotional intelligence. This qualitative descriptive study aims to describe pupils' conceptual understanding of mathematics in relation to their level of emotional intelligence (high, moderate, and low). The research consisted of three from class X E-3 at SMA Wachid Hasyim 2 Taman, representing each level of emotional intelligence. Data were collected using an emotional questionnaires, an essay tests on quadratic functions, and structured interviews guides. The data were analyzed through data reduction, data display, conclusion drawing, and triangulation to ensure the validity of the findings. The results of the study indicate that student with high emotional intelligence have a very good conceptual understanding of mathematics. Meanwhile, the student with moderate emotional intelligence demonstrated a good level of understanding, and the student with low emotional intelligence showed poor conceptual understanding. It can be concluded that student' level of emotional intelligence is related to their conceptual understanding.
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I. INTRODUCTION

Mathematics education serves as a structured thinking mechanism related to logical reasoning, which systematically enables learners to master core concepts, foster creativity, and achieve operational efficiency. These skills form the foundation for problem-solving in mathematics learning. It can be concluded that a students' strong conceptual understanding underlies their ability to think critically in mathematics education (Diana et al., 2020; Apriliyana, et al., 2023; Margaretha Silvia et al., 2024).

Success in mathematics learning is not only influenced by cognitive factors but can also be influenced by internal factors that support students' learning processes, such as emotional intelligence. Emotional intelligence helps students manage, recognize, and control their own emotions as well as those of others, enabling them to tackle learning challenges more effectively (Prayitno, S.H., & Utami, 2021; Wulandari & Astutiningtyas, 2020). Previous research demonstrates that emotional intelligence carries a positive relationship with conceptual understanding of mathematics in

the learning process (Ariningtyas et al., 2021; Panduwinata et al., 2023; Lepertery et al., 2022).

Most previous studies have used a quantitative approach focused on the relationships and influences between variables. Consequently, they do not provided an in-depth description of students' conceptual understanding based on their specific level of emotional intelligence, rely on limited indicators, and remain largely the junior high school level. The results of observations at SMA Wachid Hasyim 2 Taman indicate that mathematics teachers in the classroom have never assessed students' conceptual understanding.

Based on the results of the observations, this study aims to analyze students' mathematical conceptual understanding across high, moderate, and low levels of emotional intelligence. This research is expected to contribute to mathematics instruction by integrating both the cognitive and emotional aspects of learners.

II. MATERIALS AND METHODS

This study employed a qualitative descriptive approach to describe students' conceptual understanding based on

mathematics their level of emotional intelligence. The study was conducted at SMA Wachid Hasyim 2 Taman during the 2025/2026 school year. Three students from Class X E-3 were selected based on the results of a previously completed emotional intelligence questionnaire and explicit recommendations from their mathematics teacher to represent the high, moderate, and low emotional intelligence categories.

Data were collected using three instruments: an emotional intelligence questionnaire, an essay test on quadratic functions, and an interview guide. The questionnaire categorized the students' emotional intelligence levels, while the diagnostic essay test identified their mathematical conceptual understanding, and the interviews were conducted to explore students' conceptual mastery in greater depth based on their respective emotional intelligence strata.

Data analysis was performed through data reduction, data presentation, data interpretation, and drawing conclusions. Data validity was ensured through triangulation, which involved examining the results of questionnaires, tests, and interviews to provide an overview of students' conceptual understanding based on their level of emotional intelligence.

III. RESULT AND DISCUSSION

Three participants representing high (CEH), moderate (CEM), and low (CEL) levels of emotional intelligence were selected through purposive sampling. Their classifications are presented in table I.

Table I: Research Subject

No.	Student Name	Emotional Intelligence Quis Score	Categori Emotional Intelligence Levels	Code
1	DSK	95	High	CEH
2	ARS	50	Moderate	CEM
3	AS	20	Low	CEL

Conceptual understanding is a thinking process that involves reasoning by connecting previously learned concepts, principles, and theories to solve problems. Demonstrating conceptual understanding is not merely about memorizing formulas, but involves the ability to connect concepts, apply them, and solve problems (Nurhangesti, 2024).

Subsequently, a mathematical conceptual understanding test focusing on quadratic functions was administered to the subjects selected from each emotional intelligence level.

A. Mathematical Conceptual Understanding of Students with High Emotional Intelligence (CEH)

The following will explain the research findings, which show that subjects with high emotional intelligence (CEH)

meets the fifth indicator of conceptual understanding very well. The results of the students' answers show that they were able to restate the information provided, accurately present concepts in mathematical form, correctly apply procedures using the ABC formula, and perform calculations accurately to solve the problems. Figure 1 below shows examples of students' work that demonstrate conceptual understanding in the high emotional intelligence category (CEH)

Figure 1. CEH Test Results

Researcher “P” then conducted the following interview with subject CEH;

P : “How do you solve the problems in the questions?”

CEH : “Substitute the previously known equation into the quadratic function form, then solve the resulting equation in the general form of a quadratic function using the ABC formula”

P : “What results have you achieved so far?”

CEH : “The final result I obtained from applying the ABC formula is that it takes 2 seconds for the balloon to touch the ground”

The results of the interview excerpts indicate that CEH students are able to solve problems in a systematic manner and explain the formulas used. CEH students are able to manage their emotions while working on problems, so they do not feel stressed or have difficulty solving them. In conclusion, CEH is able to write down known problems and calculate them accurately, without missing anything, so that they can arrive at the final answer.

B. Mathematical Conceptual Understanding of Students with High Emotional Intelligence (CEM)

Subsequently, the research findings indicated that subject with moderate emotional intelligence (CEM) demonstrated a sufficient level of conceptual understanding. Students met some of the indicators, particularly in restating concepts and presenting mathematical representations, they were able to write down information obtained from the problems, but errors occurred during the calculation stage due to a lack of precision in using specific procedures or operations and in applying concepts algorithmically to solve problems. Figure 2 presents the students' work, which represents conceptual

understanding ability in the moderate emotional intelligence (CEM) category.

Given
 Diketahui:
 The path of the air balloon
 lintasan balon udara : $h(t) = 24 - 6t^2$
 t = seconds
 t = detik

Question : How long does it take for the balloon to touch the ground?
 Ditanya : Berapa lama waktu yang dibutuhkan balon udara tsbt untuk menyentuh tanah

Answer :
 Jawab :
 a. Substitute the given equation into the general form of a quadratic function
 a. Substitusi persamaan yang ada ke dalam bentuk umum fungsi kuadrat
 $y = ax^2 + bx + c$
 $h(t) = -6t^2 + 0t + 24$

b. Substitute into the ABC formula
 b. Substitusi rumus ABC

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t_{1,2} = \frac{-0 \pm \sqrt{0^2 - 4(-6)(24)}}{2(-6)}$$

$$t_{1,2} = \frac{\pm \sqrt{576}}{-12}$$

$$t_{1,2} = \frac{\pm 24}{-12}$$

$$t_1 = \frac{24}{-12} = -2$$

$$t_2 = \frac{-24}{-12} = 2$$

Figure 2. CEM Test Results

Researcher “P” then conducted the following interview with subject CEM;

P : “How do you solve the problems in the questions?”

CEM : “Using the ABC formula, by substituting the equation obtained earlier”

P : “What results have you achieved?”

CEM : “I haven't found the final results yet”

Based on the interviews with the CEM subjects, the findings indicated that although they understood the basic concepts and could identify examples and non-examples, they lacked precision during the problem-solving process—particularly in executing calculation procedures and applying mathematical concepts. Consequently, this prevented them from obtaining the correct final results. It was concluded that while the CEM students were capable of grasping fundamental concepts, their calculations lacked accuracy. Emotionally, the CEM subjects exhibited a lack of confidence when encountering complex numerical operations, which caused their concentration to waver. As a result, despite implementing the correct initial steps, they failed to resolve the final calculations.

C. Mathematical Conceptual Understanding of Students with Low Emotional Intelligence (CEL)

subjects with low emotional intelligence (CEL) demonstrated poor conceptual understanding. As seen in the test results, CEL students were able to state some of the information in the questions and use formulas, but they had difficulty accurately presenting mathematical representations and were unable to perform calculations correctly. Figure 3 below presents the students’ work, which demonstrates their conceptual understanding within the low emotional intelligence (CEL) category.

Given
 Diketahui:
 The path of the air balloon
 lintasan balon udara : $h(t) = 24 - 6t^2$
 t = seconds
 t = detik

Question : How long does it take for the balloon to touch the ground?
 Ditanya : Berapa lama waktu yang dibutuhkan balon udara tsbt untuk menyentuh tanah?

Answer :
 Jawab :
 a. Substitute the given equation into the general form of a quadratic function
 a. Substitusi persamaan yang ada ke dalam bentuk umum fungsi kuadrat
 $y = ax^2 + bx + c$
 $h(t) = -6t^2 + 0t + 24$

b. Substitute into the ABC formula
 b. Substitusi rumus ABC

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t_{1,2} = \frac{-0 \pm \sqrt{0^2 - 4(-6)(24)}}{2(-6)}$$

$$t_{1,2} = \frac{\pm \sqrt{576}}{-12}$$

$$t_{1,2} = \frac{\pm 24}{-12}$$

$$t_1 = \frac{24}{-12} = -2$$

$$t_2 = \frac{-24}{-12} = 2$$

Figure 3. CEL Test Results

Researcher “P” then conducted the following interview with subject CEL;

P : “How do you solve the problems in the questions?”

CEL : “I asked a friend earlier, and they said to substitute the equation into the general form of a quadratic function, then use the ABC formula”

P : “What results have you achieved?”

CEL : “I’m still confused about the results I’ve gotten, so I asked my friend”

Interviews with CEL revealed that the student lacks a comprehensive understanding of the concepts and hesitates when determining the steps to solve problems, which is why CEL has not yet been able to arrive at a final answer. It was concluded that CEL lacks self-confidence and is overly dependent on others. Difficulties in managing emotions make it hard for KER to grasp the concepts behind the problems, resulting in the student being able to solve only the simplest parts.

Based on the results of the assignments given to students and interview excerpts, table II presents indicators of conceptual understanding adapted and modified from (Syaifar et al., 2022) and presented in table II below regarding the level of achievement of these indicators, while table III presents the results of the assessment of students’ conceptual understanding of quadratic functions, categorized according to high, moderate, and low levels of emotional intelligence.

Table II: Achievement of Conceptual Understanding Indicators

No.	Indicator of Conceptual Understanding in Mathematics	Research Subject		
		CEH	CEM	CEL
1	Rephrase the concept	Meets	Meets	Meets
2	Identify examples and non-examples	Meets	Meets	Does not meet
3	Presenting	Meets	Meets	Does

No.	Indicator of Conceptual Understanding in Mathematics	Research Subject		
		CEH	CEM	CEL
	concepts in the form of mathematical representations			not meet
4	Use specific procedures or operations	Meets	Does not meet	Does not meet
5	sand applying algorithmic concepts to problem-solving	Meets	Does not meet	Does not meet

Table III. Results of the Assessment of Conceptual Understanding of Mathematics

Subject	Score	Category Conceptual Understanding of Mathematics
CEH	100	Very Good
CEM	78	Good
CEL	35	Not Good

Table II shows the varying characteristics of conceptual understanding among students with high, moderate, and low emotional intelligence. Students with high emotional intelligence met all the indicators of the concept, while students with moderate emotional intelligence demonstrated understanding but made errors in their calculations. Meanwhile, students with low emotional intelligence had difficulty representing the problem and selecting a solution strategy that right strategies to solve them.

Table III above shows the results of the conceptual understanding test, indicating that students with high emotional intelligence demonstrate excellent conceptual understanding. This aligns with the findings of (Aulia et al., 2022) who stated that students with high emotional intelligence are capable of understanding concepts meaning they can restate the information presented in the questions and clearly explain what the researcher asked during the interview. Students with moderate emotional intelligence demonstrated good results on the conceptual understanding test; they were able to meet some of the indicators of conceptual understanding, but still made errors in calculating certain operations within the problems. This is consistent with research conducted by (Lepertery et al., 2022) which found that while there were still some difficulties in problem-solving, students were generally able to solve the problems correctly. Furthermore, students with low emotional intelligence demonstrated poorer conceptual understanding. The results showed that students

with low emotional intelligence were able to meet one indicator of conceptual understanding, although their solutions were incomplete. This aligns with research conducted by (Ariningtyas et al., 2021) who found that students with low emotional intelligence still had poor conceptual understanding; they did not meet the indicator of restating concepts and experienced difficulties in understanding the meaning of the problems presented. In line with previous research (Aulia et al., 2022; Panduwina et al., 2023) it has been found that students' conceptual understanding correlates with their level of emotional intelligence.

A student's level of emotional intelligence influences their conceptual understanding of mathematics. Previous research findings indicate that emotional intelligence has a positive correlation with students' conceptual understanding.

IV. CONCLUSION

In conclusion, this study demonstrated that there are distinct differences in mathematical conceptual understanding across various levels of emotional intelligence. Students with high emotional intelligence met all indicators of conceptual understanding exceptionally well, as demonstrated by their ability to restate concepts, identify examples and non-examples, present concepts in mathematical representations, execute specific procedures, and apply concepts algorithmically to solve problems. Meanwhile, students with moderate emotional intelligence possessed a sufficient conceptual understanding, as evidenced by their fulfillment of certain indicators, although they lacked precision in calculations and completeness in their solution steps.

It was concluded that the level of emotional intelligence is related to conceptual understanding of mathematics; the higher the students' emotional intelligence, the better their conceptual understanding of mathematics.

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