

## THE RELATIONSHIP BETWEEN LEARNING STYLES AND UNDERSTANDING MATHEMATICAL CONCEPTS IN QUADRATIC FUNCTIONS

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### Abstract

*The research teka-teki is that students are experiencing difficulties in understanding the concept of quadratic functions. The aim of the study is to determine the relationship between learning styles and mathematical concept understanding in solving quadratic function problems among 9th grade students at SMP Negeri 3 Ulunoyo. This research adopts indah ambang quantitative approach with indah ambang correlational study type. The population in this study consists of 20 9th grade students from SMP Negeri 3 Ulunoyo, and the sampling technique used is besaran sampling. The instruments used are questionnaires and tests of mathematical concept understanding. Based on the research results, indah ambang correlation coefficient of 0.64 was obtained, indicating indah ambang positive and strong correlation. The coefficient of determination is 40.96%, showing that the contribution of learning styles to concept understanding is 40.96%, with the remaining contribution attributed to other factors. The calculated t-value is 3.50324, and to determine the critical t-value at indah ambang 0.05% significance taraf, the t-table value is 2.100922. Since the calculated t-value (3.50324) is greater than the t-table value (2.100922), it can be concluded that there is indah ambang relationship between learning styles and mathematical concept understanding among 9th grade students at SMP Negeri 3 Ulunoyo, with the correlation taraf falling into the moderate category. Therefore, the researcher suggests (1) students should recognize their own learning styles and optimize them to facilitate better learning and achieve optimal performance, and (2) teachers are encouraged to adapt their teaching styles to meet the needs of all students, not just those with specific learning styles.*

**Keywords:** *Learning styles; mathematical concept understanding; quadratic functions*

### A. Introduction

Education plays a crucial role in improving the quality of human resources. The development of fields, knowledge, and technology challenges various aspects of activities that push individuals into an increasingly competitive global environment. One of the impacts of this

situation is the need to cultivate quality human resources in Indonesia. The goals of education should focus on benefiting individuals, such as learning and educational objectives, as well as the moral and ethical values they embody, and the practical aspects of education. This aligns with Sardiman (2017:59), who stated, "The

goals of education and teaching are to harmonize the character of individuals and to cultivate a democratic society that contributes to the welfare of the community and the world.”

Schools implement a teaching approach that aligns with a predetermined schedule of lessons. This teaching activity is conducted to equip students with essential skills and knowledge. According to Ahmad Susanto (2016:186), one fundamental aspect of education at the university level is mathematics, which plays a crucial role in the broader field of knowledge and is imparted to students from an early age. This foundational education enables students to develop logical, rational, critical, and creative thinking skills, empowering them to tackle various challenges in daily life and explore other subjects.

Mathematics is a discipline taught at every level of formal education in Indonesia, from elementary schools to higher education. The role of mathematics is essential in every aspect of skill development. Its influence extends to the advancement of technology, information, and communication. Mathematics serves as a universal subject that underpins modern technological processes and is vital across various fields, contributing significantly to individual endeavors.

One of the gifts of mathematics education is the understanding of concepts. Conceptual understanding allows students to grasp frameworks and apply logical,

critical, creative, and innovative strategies, enabling them to solve problems effectively. Understanding mathematical concepts is vital in mathematics education, as the subject fundamentally involves principles that are abstract and symbolic in nature. Hudojo (2003:108) states that “The concept in mathematics is an abstraction that allows us to interpret objects or events and clarify whether these objects or events are countable or measurable within a given framework.” This emphasizes that understanding mathematical concepts guides students in interpreting problems and issues.

Conceptual understanding is a fundamental skill necessary for engaging with mathematical tasks and achieving educational objectives in mathematics. Therefore, educators must recognize and address the varying conceptual understandings of students within their lesson plans. If educators do not pay attention to students' conceptual understandings, it may lead to a decline in students' perceptions of the material presented. According to Umbra (2017:12), “In mathematics education, the most important role of a teacher is to ensure that their students understand that what they will learn consists of mathematical frameworks that can be applied in everyday life, highlighting that mathematics is built upon these frameworks.”

In this matter, the educator plays a crucial role in enhancing students' understanding of design in the school curriculum by

ensuring that students recognize that arithmetic tasks should be supported by designs that are conducive to learning. According to Hartono (2013:28), "A dedicated teacher will certainly cultivate a type of student who is also dedicated. Education is not merely about imparting moral subjects but also about transferring moral values and perspectives. When dealing with students who may not fully grasp moral concepts, a dedicated teacher will strive to create an engaging school environment that inspires more students. They also reflect on and observe the learning models they employ with students, enabling them to address the issues faced and adapt to the learning styles of the students."

Aside from the understanding of design in arithmetic education, there are several other issues that must be addressed, one of which is learning styles. Learning styles are very important in educational techniques; recognizing students' learning styles can enhance their perception of the subject matter or evidence being taught, creating a conducive and engaging learning environment for both educators and students.

Learning styles encompass the most effective and preferred ways individuals absorb, process, and organize the information they receive. Each individual has a unique learning style that may differ from others. According to Hernacki (2013:110), "Learning styles can be categorized into three types: visual learning style, auditory learning style, and

kinesthetic learning style. The visual learning style involves habits of seeing, observing, and watching. The auditory learning style focuses on absorbing information through listening and utilizing auditory senses. The kinesthetic learning style involves habits of movement, hands-on activities, and touching." By recognizing students' learning styles, educators can design the curriculum using various models, structures, and methods that align with these styles. This variety in the curriculum will help create a conducive, engaging learning environment that caters to students' needs and enhances their understanding of the material.

Based on preliminary research findings, it was determined that students struggle to grasp the concept of quadratic functions, specifically in relation to the properties of quadratics, as outlined in the 2013 curriculum. This aligns with observations that students in class IX at SMP Negeri 3 Ulunoyo experience difficulties in understanding the characteristics of quadratic functions, particularly regarding their graphical representations. This is partly due to a lack of motivation from educators towards varied teaching approaches. Although students are able to perform calculations related to quadratic properties, they still struggle with the concepts.

As a result, several issues stem from a lack of motivation among educators regarding diverse teaching methodologies. This methodology is crucial because it affects both the learning process and

students' comprehension of the material. According to Gunawan (2003:139), "The learning style of students significantly influences their understanding of arithmetic concepts, particularly in addressing the problems associated with quadratic functions."

Therefore, in this study, the researcher seeks to explore the relationship between learning styles and the understanding of concepts, leading to the title "The Relationship Between Learning Styles and Understanding Mathematical Concepts Regarding Quadratic Functions Among Class IX Students at SMP Negeri 3 Ulunoyo." The researcher is motivated to conduct this study to examine the correlation between learning styles and the understanding of arithmetic concepts in addressing quadratic functions.

## **B. Research Methodology**

### **1. Approach and Type of Research**

This research employs a quantitative approach based on statistical evidence. The examination approach addresses the complexities of research by applying a systematic scaling of the independent variables related to the studied subjects, allowing for generalization based on temporal, contextual, and situational conditions. According to Sugiyono (2016), the quantitative research approach can be understood as a research framework rooted in positivism, used to observe specific communities or patterns. The method of data collection is generally conducted randomly, utilizing research instruments to gather quantitative data or descriptions to

assess clearly defined hypotheses. This type of research is correlational. According to Sugiyono (2016), correlational research establishes a framework that explores the nature of the relationship between two or more variables. The purpose of this research is to determine whether there is a relationship between the variables or to estimate the correlation based on the relationships among the variables.

### **2. Population and Sample of the Research**

#### **a. Population**

According to Sukardi (2010:53), the population is defined as all human beings, animals, events, or products residing within a single scope and systematically serving as subjects of analysis based on the outcome of a study. This definition aligns with Sugiyono (2016:117), who describes the population as a generalization area formed from objects/studies that have specific characteristics and properties determined by the researcher to be studied and later drawn conclusions. In this study, the population is the ninth-grade students of SMP Negeri 3 Ulunoyo, totaling 20 students.

#### **b. Sample of the Research**

A sample is a portion derived from the characteristics and qualities possessed by the defined population. Sugiyono (2016:149) states that when researchers conduct a large study, they often have constraints regarding funds, manpower, and time, leading them to use a representative method. Thus, the representative sample taken can reflect the population that has been established. In this

analysis, the entire body of ninth-grade students at SMP Negeri 3 Ulunoyo is considered as the representative sample, consisting of 20 individuals.

### 3. Location and Time of the Research

This research was conducted at SMP Negeri 3 Ulunoyo in Class IX, located in Suka Maju Village, Ulunoyo District, and Nias Selatan Regency. The study was carried out on Saturday, April 20, 2024, during the second semester of the 2024 academic year.

### 4. Operational Definitions

To avoid misinterpretation and ambiguity, it is necessary to clarify the definition of "understanding," which refers to the sharpness of perception possessed by each individual. Therefore, it can be concluded that understanding is an individual's ability to grasp the essence of a concept, explore it in depth using their own approach, and accept different perspectives that are exemplified through practical experiences in various contexts.

The concept encompasses a group of objects, events, or symbols that share identifiable characteristics. According to Sanjaya (2008), understanding is an abstraction of similarities or relationships among a group of elements or properties, while Hamrik (2005) describes understanding as a collection or order of stimuli possessing common characteristics. The understanding of a concept is the ability of students to engage with various subjects, to articulate their insights through different frameworks, to interpret information, and to apply the

understanding in alignment with cognitive constructs.

### 5. Research Instruments

The instruments used in this research are tools selected by the researcher to facilitate the data collection process, ensuring that the plan is consistently recorded and made easier. The instruments used to obtain the necessary data for this study include:

#### a. Questionnaire (Survey)

The questionnaire is designed to gather the necessary data. The researcher employs a structured instrument in the form of a questionnaire or survey, which is a method for investigating a particular topic that generally relates to overall effectiveness (various aspects). This method involves administering a questionnaire designed to elicit responses on several bases to obtain comprehensive feedback.

The questionnaire includes items that capture learning styles. Participants are expected to indicate their preferences among sensory modalities: visual, auditory, and kinesthetic, and to reflect on which they are more inclined to use. According to Rose & Nicholl (1997), we all possess these three learning styles; however, typically, one style tends to dominate. Participants will complete the questionnaire by marking their responses with a check (✓) next to the statements provided. The questionnaire contains 30 items related to learning styles, reflecting the three



types: visual, auditory, and kinesthetic, and includes five response options: Strongly Agree (SA), Agree (A), Uncertain (U), Disagree (D), and Strongly Disagree (SD). Students will check the option that best matches their experiences in relation to the statements presented in the questionnaire.

#### b. Data Collection Process

The researcher will use a checklist format to streamline the data collection process. The data obtained will be based on nominal or ratio scales. This follows the guidelines provided by Sugiyono (2012), which outline how to determine the response scores in a structured manner.

#### c. Validation of the Questionnaire

Before the questionnaire is utilized in the study, it will undergo validation by three expert validators and will then be pilot tested at SMP Swasta BNKP in Teluk Dalam.

### 6. Data Collection Techniques

The data collection techniques used by the researcher involve obtaining information continuously at the research location. Several methods for collecting data include experiments and questionnaires. The data collection techniques used in this study are as follows:

#### a. Questionnaire (Survey)

The questionnaire is a method of gathering information by providing structured questions for respondents to answer. It aims to collect specific data by posing relevant questions. The researcher employs a structured questionnaire to

gather information about students' learning styles. At this stage, the researcher designs a tool to be given to students to assess their understanding of learning styles. In this study, a checklist format is used. The questionnaire includes items that capture characteristics of visual, auditory, and kinesthetic learning styles, supplemented by response options where respondents can indicate their preferences by marking a check next to the provided options.

#### b. Concept Understanding Test

The test administered for the purpose of the research is a test constructed by the researcher. According to Kilpatrick et al. (2001), the understanding test involves reporting on learning materials, classifying responses based on mathematical concepts, identifying patterns that are not derived from the studied materials, and connecting various mathematical concepts, both internally and externally.

### 3. Data Analysis Techniques

This analysis technique is quantitative research that presents data in the form of questionnaires. This study consists of two variables: the independent variable and the dependent variable.

#### a. Correlation Coefficient

To determine the relationship between two variables, namely the learning styles and the understanding of mathematical concepts, the product moment correlation formula is used as follows (Arikunto, 2012:87).

$$r_{xy} = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{\{N \sum X^2 - (\sum X)^2\} - \{N \sum Y^2 - (\sum Y)^2\}}}$$

Where:

$r_{xy}$  = Correlation coefficient

X = Value of Variable X

Y = Value of Variable Y

N = Number of Respondents

### c. Coefficient of Determination

To interpret the magnitude of the correlation coefficient, it is categorized as follows (Sugiyono, 2017:184):

0.00 - 0.199 = Very low correlation

0.20 - 0.399 = Low correlation

0.40 - 0.599 = Moderate correlation

0.60 - 0.79 = Strong correlation

0.80 - 1.00 = Very strong correlation

The results of the correlation calculation between the research variables are compared with the critical value of the product moment at a significance level of 5%.

$$KD = r^2 \times 100\%$$

Where:

KD = Value of the coefficient of determination

R = Value of the correlation coefficient

### d. Hypothesis Testing

Hypothesis testing is used to determine whether the research variables can accept their hypothesis. According to Sugiyono (2012:258), "the criterion is if  $r$  calculated is greater than  $r$  table, then  $H_a$  is accepted." In other words, at a significance level of 5%, then  $H_a$  is accepted and  $H_o$  is rejected. To determine whether the hypothesis is rejected or accepted, a statistical test is conducted using Sugiyono's formula (2012:259), as follows:

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}, \text{ dengan } dk = n - 2$$

Keterangan:

T = Calculated t-value

r = calculated r-value

dk = atau degree of freedom (df)

2 = constant number

1 = constant number

## C. Research Results and Discussion

This research aims to capture the relationship between learning styles and the understanding of mathematical concepts among ninth-grade students at SMP Negeri 3 Ulunoyo in the Academic Year 2023/2024. The researcher utilized questionnaires and tests to gather data, comprising 30 questionnaire items and 6 test questions.

Learning styles play a crucial role in enhancing students' abilities across various educational endeavors, both in the classroom and in social interactions. They also significantly affect how students absorb and process information. According to Ghufroon and Risnawita (2014:10), enhancing learning styles can be achieved by carefully considering both internal and external factors, with learning style being a key component. Kosasih A. Jihiri (1978:7) also notes that learning styles encompass all elements that encourage and motivate students to learn in specified contexts. Common learning styles among middle school students include visual, auditory, and kinesthetic styles.

Understanding mathematical concepts is a key aspect of the learning process, as it allows students to develop their abilities across various subjects. This understanding is particularly vital in

mathematics, where students are expected to internalize concepts and formulas. Herman states that to grasp mathematics, students need a good perception of the concepts taught, which will facilitate their understanding of theorems and formulas.

Based on the discussion and the collection of information from the questionnaire on learning styles, it was found that the students of class IX at SMP Negeri 3 Ulunoyo have an average score for learning styles of 63.4, which falls into the good category. Among them, 6 students utilize visual learning styles, accounting for 30%; 9 students use auditory learning styles, making up 45%; and 5 students employ kinesthetic learning styles, representing 25%. Meanwhile, the average score for students' understanding of mathematical concepts is 55.75, which is categorized as sufficient.

The relationship between learning styles and the understanding of mathematical concepts among the ninth-grade students of SMP Negeri 3 Ulunoyo can be analyzed through hypothesis testing and product moment correlation analysis. The calculated correlation coefficient was found to be  $r_{xy} = 0.64$ , which indicates a strong relationship at the significance level of 0.05. Furthermore, the results of the hypothesis testing reveal that

$t_{\text{calculated}} > t_{\text{table}}$  Where  $t_{\text{calculated}} = 3,50324$  While  $t_{\text{table}} = 100922$  "This indicates that there is a relationship between learning styles and understanding of mathematical concepts."

The contribution of learning styles to understanding mathematical concepts is found to be 40.96%. This result indicates that learning styles can enhance the understanding of mathematical concepts by 40.96%, while the remaining influence comes from other factors. Based on the results of descriptive analysis and correlation estimates, it is evident that learning styles have a strong relationship with the acquisition of mathematical understanding. This aligns with the findings from the study conducted by Ahmad Assel (2012) titled "The Relationship Between Learning Styles and Understanding of Quadratic Concepts Among Eleventh Grade Students of SMP Negeri in Gorontalo City for the Academic Year 2011/2012." The aim of that research was to explain the relationship between learning styles and understanding of mathematical concepts.

The difference between Ahmad Assel's study and our research lies in the focus: while Ahmad Assel's research aimed to describe the relationship between learning styles and understanding of mathematical concepts, our study seeks to investigate the relationship between learning styles and understanding of arithmetic concepts specifically in the context of quadratic functions among ninth-grade students at SMP Negeri 3 Ulunoyo.

This is consistent with Marton's view (as cited in Ghufuron, 2014:12) that a person's ability to understand their own learning style and the learning styles of others in their environment enhances their



effectiveness in learning. Our research also parallels the study conducted by Lakilo Laruli (2021), which investigated the relationship between learning styles and students' perceptions of mathematical representation among seventh-grade students at SMP Negeri 3 Pagimana in Banggai Regency. The findings indicated a significant relationship between learning styles and the students' ability to perceive mathematical representations.

In that study, the results showed a calculated t-value ( $t_{hitung}$ ) of 14.96, with degrees of freedom ( $db$ ) =  $28 - 2 = 26$  and a significance level of 0.05 yielding a critical t-value ( $t_{tabel}$ ) of 2.05. Since  $t_{hitung}$  (14.96) is greater than  $t_{tabel}$  (2.05), it indicates a significant relationship, thus confirming the existence of a correlation between learning styles and the perception of mathematical representations in SMP Negeri 3 Pagimana, leading to the acceptance of the hypothesis.

#### D. Conclusion

Based on the analysis presented in Chapter IV, it is found that the average life perspective from the questionnaire regarding learning styles is 63.4, which falls within the "respectable" range. The average life perspective from the research on understanding arithmetic concepts is 55.75 categorized as "sufficient." Additionally, the correlation coefficient obtained is 0.64, and the coefficient of determination is 40.96%. And the scoring from the hypothesis test indicates  $t_{hat} = 3,50324$  and at a significance level of 5%, the critical value  $t_{tabel} = 2,10982$ . therefore, it can be concluded that  $t_{hat} = 3,50324 > t_{tabel} = 2,100922$ , Since  $t_{hitung}$  exceeds

$t_{tabel}$ , it can be concluded that there is a significant relationship between learning styles and understanding arithmetic concepts, as indicated by the coefficient of determination. Therefore, several recommendations are proposed for students, teachers, and researchers:

- 1 **For Students:** It is essential for students to recognize their individual learning styles and intensify their study strategies, making it easier for them to engage with lessons and master their skills optimally.
- 2 **For Teachers:** Teachers should aim to develop a nurturing environment that accommodates various learning styles, ensuring that all students can benefit, not just those with specific preferences.
- 3 **For Researchers:** It is hoped that researchers will expand the scope of their analysis by increasing the number of respondents in future studies.

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