

<https://doi.org/10.51574/kognitif.v6i2.4950>

Effect of a Contextual Teaching and Learning Models Based on Islamic Boarding School Culture on Students' Understanding of Mathematical Concepts

Firda Novita, Poppy Rachman , Athar Zaif Zairozie 

How to cite: Novita, F., Rachman, P., & Zairozie, A. Z. (2026). Effect of a Contextual Teaching and Learning Models Based on Islamic Boarding School Culture on Students' Understanding of Mathematical Concepts. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, 6(2), 794–806. <https://doi.org/10.51574/kognitif.v6i2.4950>

To link to this article: <https://doi.org/10.51574/kognitif.v6i2.4950>



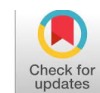
Opened Access Article



Published Online on 14 June 2026



Submit your paper to this journal



Effect of a Contextual Teaching and Learning Models Based on Islamic Boarding School Culture on Students' Understanding of Mathematical Concepts

Firda Novita^{1*}, Poppy Rachman¹ , Athar Zaif Zairozie¹

¹Department of Mathematics Education Program, Faculty of General Education, Zainul Hasan Genggong Islamic University

Article Info

Article history:

Received Apr 21, 2026

Accepted May 29, 2026

Published Online Jun 14, 2026

Keywords:

Contextual Teaching and Learning (CTL)
Islamic Boarding School Culture
Mathematical Concepts
Quasi-Experimental Research

ABSTRACT

The purpose of this study is to analyze the impact of using a Contextual Teaching and Learning (CTL) model based on islamic boarding school culture on students' understanding of mathematical concepts in the topic of arithmetic sequences and series. The study employed a quantitative approach using a quasi-experimental nonequivalent control group design. The research subjects consisted of 39 eleventh-grade students at MA Nurul Hasan Maron Probolinggo, selected using purposive sampling, comprising an experimental class and a control class. Data collection was conducted through pretests and posttests, then analyzed using descriptive statistics, normality tests, homogeneity tests, independent sample t-tests, N-gain, and effect size. The results showed a significant difference between the experimental and control classes, with a significance level of $0.000 < 0.05$ and a t-value of -4.724. The average score of the experimental class increased from 49.75 to 80.00, while that of the control class increased from 41.05 to 64.47. The experimental class's N-gain value of 0.60 (moderate category) was higher than the control class's 0.40, supported by an effect size of 1.55 (large category). These findings indicate that CTL learning based on islamic boarding school culture makes a significant difference in improving students' understanding of mathematical concepts. This study underscores the importance of integrating local cultural contexts as a meaningful and relevant source of learning that aligns with students' experiences in mathematics education.



This is an open access under the CC-BY-SA licence



Corresponding Author:

Firda Novita,
Department of Mathematics Education,
Faculty of General Education,
Zainul Hasan Genggong Islamic University,
Jl. Raya Panglima Sudirman No. 360, Semampir, Kraksaan, Probolinggo Regency, East Jawa 67282,
Indonesia
✉ mfirdanovita@gmail.com

Introduction

The mathematics learning process in madrasahs still faces the challenge of students' lack of conceptual understanding, particularly in the subject matter of arithmetic sequences and

series, which requires the ability to recognize patterns, understand relationships between concepts, represent situations, and relate them to real-life contexts (Sulastri, 2016). Data from the Programme for International Student Assessment (PISA) by the Organisation for Economic Co-operation and Development (OECD) indicates that Indonesian students' mathematical literacy remains below the international average, particularly in the areas of reasoning and applying concepts (Arifin & Nuh, 2026). This situation aligns with the results of initial observations and diagnostic tests of 11th-grade students at MA Nurul Hasan Maron Probolinggo, which showed that students struggled to explain concepts in their own words, connect concepts to real-life situations, and solve comprehension-based problems. This condition is suspected to be caused by learning that is still dominated by lectures and routine problem-solving exercises without linking concepts to everyday life situations (Apriani, & Sudiansyah, 2024). This evidence is reinforced by empirical data showing that the average pretest scores were still relatively low—49.75 in the experimental class and 41.05 in the control class—indicating that students' understanding of mathematical concepts was not yet optimal.

In this study, understanding of mathematical concepts includes the ability to restate concepts, classify objects, provide examples and non-examples, use appropriate procedures, and apply concepts to problem-solving (Safari & Nurhida, 2024). However, various studies show that students tend to master procedures without a deep understanding of the underlying concepts. Research Suhermi et al. (2024) indicates that more than 60% of students are only able to solve problems mechanically without being able to explain the reasoning behind the steps used, meaning that learning has not yet fostered meaningful knowledge construction.

To address this issue, a learning model is needed that can connect mathematical concepts with students' real-world experiences. Contextual Teaching and Learning (CTL) is an approach grounded in social constructivism, which emphasizes that knowledge is constructed through experience and interaction. Empirically, a study conducted Yanti et al. (2020) demonstrated that the implementation of CTL increased students' average understanding of mathematical concepts from 61.4 to 78.2. In the context of islamic boarding school culture, this approach is particularly relevant because students' activities, such as congregational prayer, structured daily schedules, repetitive memorization patterns, and the allocation of time for various activities, reflect mathematical patterns, including sequences and regularity. Integrating these contexts enables students to construct concepts more concretely, thereby reducing the abstract nature of mathematics and enhancing conceptual understanding (Wathoni, 2024).

CTL research in mathematics education generally uses general everyday contexts, such as buying and selling activities, the home environment, or formal school activities. However, there is still little research that utilizes islamic boarding school culture as a source of mathematical context, even though madrasah students living in a pesantren environment have unique learning experiences and social activities. The novelty of this study lies in the use of islamic boarding school culture as an authentic context in CTL, where the daily experiences of santri (pesantren students) not only serve as a backdrop for learning but are constructed as sources of mathematical situations to build conceptual understanding. This integration is implemented through the development of Student Worksheets (LKPD), sample problems, and learning activities that link the concepts of sequences and series to patterns of student activities, such as the order of the daily schedule, patterns of memorization repetition, the arrangement of prayer rows, and the arrangement of books on shelves. Conceptually, this approach differs from previous CTL implementations because it places local culture at the core of the knowledge-construction process, rather than merely as a contextual illustration. Based on the above description, the purpose of this study is to examine the impact of using a pesantren-culture-based Contextual Teaching and Learning (CTL) model on students' understanding of

mathematical concepts in the topic of sequences and series in the 11th grade at MA Nurul Hasan Maron Probolinggo.

Method

Research Design

This study employs a quantitative approach using a quasi-experimental Nonequivalent Control Group Design to test the effect of the pesantren-culture-based Contextual Teaching and Learning (CTL) model on students' mathematical concept understanding. The study involves two groups: an experimental class receiving pesantren-culture-based CTL instruction and a control class using conventional teaching methods (Rahmawati et al., 2023). We employed a quantitative approach using a quasi-experimental design known as the Nonequivalent Control Group Design (Abraham & Supriyati, 2022). The study involved two groups: an experimental group that received instruction using the Contextual Teaching and Learning (CTL) model based on islamic boarding school culture, and a control group that used conventional teaching methods. Both groups were administered pretests and posttests to measure changes in students' understanding of mathematical concepts. The effect of the intervention was analyzed by comparing the results of the two groups before and after instruction. The research design is presented in Table 1.

Table 1. Pretest–Posttest Research Design

Research Subjects	Pre-test	Treatment	Posttest
Experimental Group	Pretest (O ₁)	Implementation of the CTL Model Based on islamic boarding school Culture (X)	Posttest (O ₂)
Control Group	Pretest (O ₃)	Conventional Learning (-)	Posttest (O ₄)

Notes:

O₁ = Pretest for the experimental group to measure students' initial mathematical concept comprehension before the intervention.

O₂ = Posttest for the experimental group to measure students' mathematical concept comprehension after the intervention.

O₃ = A pretest administered to the control group to measure students' initial mathematical concept comprehension before the learning process begins.

O₄ = Posttest for the control group to measure students' mathematical concept comprehension after the learning process began.

X = Treatment involving the application of the Contextual Teaching and Learning (CTL) model based on islamic boarding school culture in mathematics instruction.

(-) = Learning using a conventional learning model without any special treatment.

Subjects/Population and Sample

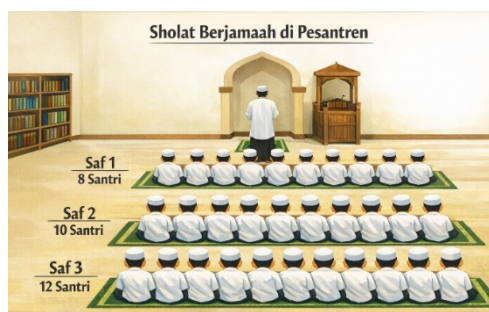
The population of this study consisted of all 11th-grade students at MA Nurul Hasan Maron Probolinggo during the 2025/2026 academic year, with a total of 39 students. The population was divided into two classes: Class 11A, comprising 20 female students, and Class 11B, comprising 19 male students. The sampling technique used was purposive sampling, which involves selecting a sample based on specific criteria or considerations (Kiareni & Sorisa, 2024). The sample in this study included Class XI A as the experimental class and Class XI B as the control class, selected because they align with the class characteristics and research requirements.

Instruments

The research instrument consists of an essay test designed to measure mathematical concept comprehension, based on the following indicators: restating concepts, classifying objects, providing examples and non-examples, following procedures, and applying concepts to problem-solving (Pranata, 2016). This instrument includes a question matrix and a scoring rubric. The instrument's suitability was assessed through content validity using the expert judgment method by mathematics education faculty members to ensure that the test items aligned with the indicators. Subsequently, the instrument was pilot-tested, followed by an empirical validity test using the product-moment correlation to determine the validity level of each item (Fitriana, 2022). Reliability testing was conducted using Cronbach's Alpha to demonstrate the instrument's consistency. In addition to the tests, observation and documentation sheets were used as supporting data in the experimental and control classes. The observation sheets were also validated by experts to ensure they aligned with the research objectives, so that all instruments were deemed suitable for use (Pratama & Saregar, 2019). The test instrument blueprint for mathematical concept understanding used in this study is presented in Table 2.

Table 2. Concept Understanding Test Instrument

Instruments	Descriptions
<p>Assignment #1. Every day, the students perform congregational prayers at the boarding school mosque. The boarding school administrators arrange the prayer rows neatly. Based on observations, the number of students in each row always increases by a constant difference compared to the previous row.</p>	<p>Students are asked to restate the concept of an arithmetic sequence in their own words based on their observation of patterns in the context of prayer rows. This is evident in question 1, where students explain whether the pattern constitutes an arithmetic sequence by considering the difference between terms.</p>



Based on the illustration of the row arrangement, determine whether the pattern of the number of students in each row is an arithmetic sequence. Briefly explain your answer by considering the difference in the number of students in consecutive rows.

Assignment #2. At the boarding school library, a student serving as a librarian recorded the number of books on several shelves. The data obtained is as follows:

Shelf A contains: 10, 15, 20, 25, ...

Shelf B contains: 6, 12, 24, 48, ...

Shelf C contains: 40, 35, 30, 25, ...

Based on this data:

- Determine which shelf forms an arithmetic sequence.
- Explain your reasoning by showing the difference between two consecutive terms on each shelf.

Students group data based on the characteristics of arithmetic and non-arithmetic sequences. This indicator is reflected in question 2, when students determine which sets form arithmetic sequences and provide reasons based on the differences between terms.

Instruments	Descriptions
<p>Assignment #3. During the month of Ramadan, the number of students participating in the nightly Quran recitation is recorded by the administrators. Sometimes the number increases regularly, and sometimes it does not.</p> <ol style="list-style-type: none"> Create an example of data on the number of students over 4 consecutive nights that forms an arithmetic sequence. Create an example of data that does not form an arithmetic sequence. Explain the difference between the two examples based on the difference in the number of students each night. 	<p>Students are asked to create examples of arithmetic and non-arithmetic sequences on their own. This indicator is found in question number 3, where students create two types of data and explain the differences based on the concept of difference.</p>
<p>Assignment #4. During Friday prayers in the boarding school courtyard, the first row is filled by 22 students. Since the courtyard gets wider toward the back, each subsequent row can accommodate 4 more students than the previous one.</p> <ol style="list-style-type: none"> Determine the formula to find the number of students in the nth row. Count the number of students in the 18th row. Explain your solution steps systematically and clearly. 	<p>Students use the arithmetic sequence formula to determine the nth term. This is evident in question 4, parts (a) and (b), where students determine the formula and calculate the value of a specific term systematically.</p>
<p>Assignment #5. At the boarding school library, the staff will build a multi-tiered bookshelf to store books. The top shelf holds 12 books. Each tier below it holds 5 more books than the previous tier. The bookshelf consists of 10 tiers.</p> <ol style="list-style-type: none"> How many books are on the 10th shelf? Explain your solution steps by correctly applying the concept of arithmetic sequences. 	<p>Students apply the concepts of arithmetic sequences and series comprehensively in real-world contexts. This indicator is evident in questions 4(c) and 5, where students solve contextual problems and explain their solution steps in a coherent and logical manner.</p>

Data Collection

Data collection was conducted through pretests and posttests in both classes. The data obtained were analyzed to compare improvements in learning outcomes between the experimental and control classes in order to determine the effect of implementing this learning model (Effendy, 2016). Data collection in this study was conducted in three stages, including administering a pretest to measure basic ability levels, conducting instruction, and administering a posttest to measure students' final ability. In the initial stage, a pretest was administered to the experimental and control classes to assess the students' initial understanding of mathematical concepts related to arithmetic sequences and series (Kholil & Safianti, 2019).

The next step was to conduct the lessons over three sessions. In the experimental class, the Contextual Teaching and Learning (CTL) model based on islamic boarding school culture was applied through the stages of relating, experiencing, applying, cooperating, and transferring (Ratnawati & Romansyah, 2022). In the relating stage, the teacher linked the concepts of sequences and series to the students' daily activities, such as the daily schedule at the pesantren, patterns of worship activities, and queues for activities. In the experiencing stage, students

explore contextual problems derived from boarding school life, such as memorization patterns and the regularity of activity schedules. In the applying stage, students solve problems related to real life situations, such as calculating step-by-step memorization patterns and managing study time. In the cooperating stage, students work together in groups to discuss and solve contextual problems. In the transferring stage, students summarize the concepts they have learned and apply them to other relevant situations, both within the boarding school context and in daily life. Meanwhile, the control class follows conventional learning dominated by lecture methods and problem-solving exercises without linking them to real-life contexts (Ruwaidah, 2022). During the learning phase, the researcher conducted observations with the assistance of one observer—a mathematics teacher—using an observation sheet to monitor student activities, engagement levels, and the implementation of the lesson. In the final stage, a posttest was administered to both classes to measure students' final understanding of mathematical concepts following the intervention. Additionally, documentation was used as supporting data, including instructional materials and evidence of the research implementation.

Data Analysis

Data analysis techniques were used to process research data in order to answer the research questions and test the hypotheses. The data analyzed consisted of pretest and posttest scores measuring students' understanding of mathematical concepts in the experimental and control classes following the implementation of a pesantren-based Contextual Teaching and Learning (CTL) model. Data analysis was conducted quantitatively using IBM SPSS version 22 software. The analysis began with descriptive statistics, including the mean, maximum and minimum values, and standard deviation, to describe the data. Next, prerequisite tests were conducted, namely a normality test using the Shapiro-Wilk method and a homogeneity test using the Levene Test to determine the equality of variances between groups. The data were considered normal and homogeneous if the significance value was greater than 0.05 (Agustian et al., 2025). Hypothesis testing was conducted using an independent samples t-test to determine whether there was a significant difference between the learning outcomes of students in the experimental class and the control class. The decision criterion was based on a significance level of 0.05; that is, if the p-value was less than 0.05, there was a significant difference between the two classes (Aprilia, 2021). In addition, improvements in students' understanding of mathematical concepts were analyzed using N-gain calculations to determine the level of instructional effectiveness, which was then categorized as low, moderate, or high. To strengthen the research findings, effect size calculations were also performed to determine the magnitude of the impact of applying the pesantren-culture-based CTL model on students' understanding of mathematical concepts (Sitanggang & Simanjorang, 2025).

Research Findings

Descriptive analysis was conducted to provide an initial overview of the pretest and posttest data on students' understanding of mathematical concepts in the experimental and control classes (Kriswinarso et al., 2023). This analysis includes the minimum, maximum, mean, standard deviation, and variance for both groups. The results of the descriptive analysis are presented in Table 3.

Table 3. Descriptive Statistics of Pretest and Posttest Results

Class	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Pre-test Experiment	20	30	65	49.75	8.347	69.671
Experimental Posttest	20	65	100	80.00	11.002	121.053
Control Pretest	19	30	50	41.05	6.364	40.497
Posttest Control	19	50	85	64.47	9.413	88.596
Valid N (listwise)	19					

Based on [Table 3](#), the average pretest score in the experimental class was 49.75, with a minimum score of 30 and a maximum of 65, while in the control class it was 41.05, with a minimum score of 30 and a maximum of 50. This difference in means indicates that the initial ability of students in the experimental class was slightly higher than that of the control class, although both were still at a relatively low level of ability and had not yet demonstrated optimal mastery of the concepts. This is also evident from the still fairly limited range of scores, suggesting that most students had not yet deeply understood the concepts before the intervention was administered.

After receiving instruction, both groups showed an improvement in their abilities. The average posttest score in the experimental class increased to 80.00, with a lowest score of 65 and a highest of 100, while in the control class it increased to 64.47, with a minimum score of 50 and a maximum of 85. This progress demonstrates that the learning process in both classes had an impact on students' conceptual understanding; however, the improvement in the experimental class was greater than that in the control class. In addition, the standard deviation in the experimental class was 11.002 and in the control class was 9.413, indicating variation in scores between the two groups after the lesson. The variance in the experimental class was 121.053 and in the control class was 88.596, indicating that the spread of data in the experimental class was greater than in the control class. This suggests that although there was a fairly high increase in the mean in the experimental class, the level of variation in student learning outcomes was also greater.

In conclusion, the results of the descriptive analysis demonstrate that teaching using the Contextual Teaching and Learning (CTL) model based on islamic boarding school culture tends to lead to a higher level of mathematical concept understanding compared to conventional learning ([Putri et al., 2025](#)). Furthermore, a normality test was conducted to determine whether the data were normally distributed, as this is one of the prerequisite tests before hypothesis testing. The results of the normality test are presented in [Table 4](#).

Table 4. Results of the Normality Test for Students' Mathematical Concept Understanding Ability Test

Result	Kelas	Shapiro-Wilk		
		Statistic	df	Sig.
	Pre-test Control	.914	19	.089
	Control Posttest	.959	19	.562
	Experimental Pretest	.959	20	.529
	Experimental Posttest	.934	20	.184

Based on [Table 4](#), the significance value (Sig.) for the control class's pretest data was 0.089, for the control class's posttest data was 0.562, for the experimental class's pretest data was 0.529, and for the experimental class's posttest data was 0.184. All significance levels were higher than 0.05, so it can be concluded that the pretest and posttest data for both classes were normally distributed. Next, a homogeneity test was conducted to determine whether

the variances of the data in the experimental and control groups were homogeneous or not. The homogeneity test was performed using Levene's Test with the aid of IBM SPSS software. The results of the homogeneity test are presented in [Table 5](#).

Table 5. Results of the Levene Test for Homogeneity

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	1.872	3	74	.142
	Based on Median	1.849	3	74	.146
	Based on Median and with adjusted df	1.849	3	67.026	.147
	Based on trimmed mean	1.934	3	74	.131

Based on [Table 5](#), the significance value (Sig.) for the "Based on Mean" approach is 0.142. Since this value is greater than 0.05, it can be concluded that the data variance between the experimental and control classes in the experiment is homogeneous. This result is also supported by the significance values in other approaches, namely Based on Median at 0.146, Based on Median and with adjusted df at 0.147, and Based on trimmed mean at 0.131, all of which show values greater than 0.05. Thus, the data meet the assumption of homogeneity of variance, so the hypothesis test can proceed using a parametric test, namely the independent sample t-test. The results of the independent sample t-test are presented in [Table 6](#).

Table 6. Independent Sample T-test for Students' Mathematical Concept Comprehension

Result		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
t	Equal variances assumed	.709	.405	-4.724	37	.000	-15.52632	3.28684	-22.18609	8.86654
	Equal variances not assumed			-4.743	36.614	.000	-15.52632	3.27347	-22.16136	8.89127

The results of the independent samples t-test are presented in [Table 6](#). Based on the analysis, a significance score (Sig. 2-tailed) of 0.000 was obtained, which is less than 0.05. This indicates that there is a significant difference between the posttest results of the experimental class and the control class, so the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted. A t-value of -4.724 with 37 degrees of freedom (df) indicates that the difference in means between the two classes is quite significant. The mean difference of -15.526 indicates that the mean score of the experimental class is higher than that of the control class. Furthermore, the 95% confidence interval ranges from -22.186 to -8.867 and does not include zero, thereby reinforcing the existence of a significant difference between the two groups.

To determine the extent of improvement in students' understanding of mathematical concepts, an N-gain analysis was conducted. The N-gain calculation was performed using the formula for the difference between posttest and pretest scores, adjusted to the highest possible value of [Bolo et al. \(2025\)](#). Based on the results of the calculation, the average N-gain value in the experimental class was 0.60, which is classified as moderate, while in the

control class it was 0.40, which is also in the moderate category but lower than that of the experimental class. This indicates that the improvement in students' understanding of mathematical concepts in the experimental class was better than that in the control class.

In addition, an effect size calculation was performed using Cohen's *d* to determine the magnitude of the impact of implementing the learning model. The results showed a Cohen's *d* value of 1.55, which falls into the "large effect" category. This indicates that the implementation of the Contextual Teaching and Learning (CTL) model based on islamic boarding school culture makes a significant difference in improving students' understanding of mathematical concepts (Siswanto et al., 2025).

Discussion

The results of the study indicate differences in the understanding of mathematical concepts between the experimental and comparison classes following instruction. These differences are supported by statistical test results showing statistical significance (Sig. < 0.05) as well as higher N-gain and effect size values in the experimental class. These findings indicate that the application of the Contextual Teaching and Learning (CTL) model based on islamic boarding school culture contributes more strongly to improved conceptual understanding compared to conventional instruction. This improvement can be explained by the development of indicators of mathematical concept understanding. Students in the experimental class began to be able to restate the concepts of sequences and series in their own words, classify types of sequences more accurately, and correctly identify examples and non-examples. In addition, their ability to use procedures also improved. However, regarding the indicator of applying concepts to solve more complex contextual problems, some students still struggled, particularly when integrating multiple concepts simultaneously. This indicates that the aspect of concept transfer still requires reinforcement.

Theoretically, these findings align with the constructivist approach in CTL, in which knowledge is constructed through meaningful experiences. In the context of Islamic boarding school culture, the construction process occurs when students relate mathematical concepts to real life experiences, such as the patterns of daily schedules, the increasing volume of memorization, and the allocation of time for worship, which form patterns of arithmetic sequences and series. This context functions as a learning ecology that supports the formation of conceptual understanding in a more concrete way, as students do not merely receive information but construct meaning themselves from experiences closely tied to their lives.

The findings of this study align with the research at Dayani & Hasanuddin (2020) which indicates that CTL enhances mathematical conceptual understanding, as well as the research at Suhermi et al. (2024) which found that procedural learning tends to hinder conceptual understanding. The similarity of this study lies in the effectiveness of CTL in improving conceptual understanding, while the difference lies in the use of the pesantren cultural context as a source of mathematical situations. Thus, the results of this study do not contradict but rather reinforce previous findings while expanding the application of CTL within a local cultural context.

The novelty of this study lies in the integration of islamic boarding school culture as an authentic context that serves not merely as an illustration but as a primary source of learning in the development of mathematical concepts. This approach demonstrates that cultural values and activities can be integrated into mathematics instruction as part of a contextual strategy that is more relevant and meaningful to students. Nevertheless, this study has limitations. First, the relatively short duration of the instruction has not yet been able to illustrate the long-term impact. Second, the study was limited to arithmetic sequences and series. Third, the sample size

was limited to a single madrasah. Furthermore, the observational data on student activities and the implementation of instruction have not been analyzed in depth in this section; therefore, the interpretation of the results still needs to be strengthened in future research.

Conclusion

This study shows that the implementation of a Contextual Teaching and Learning (CTL) model based on islamic boarding school culture has an impact on students' understanding of mathematical concepts. This is evidenced by the difference in learning outcomes between the experimental and control classes, with the experimental class showing a greater improvement. The analysis results are also supported by the N-gain scores, which indicate a moderate improvement in the experimental class, as well as effect size values in the large category, suggesting that the implemented model has a strong impact on students' understanding of mathematical concepts. In addition to test results, the research findings are also supported by observational data showing that student engagement during instruction has increased. Students were more active in discussions, expressing their opinions, and were able to relate mathematical concepts to the context of daily life in the pesantren environment. The implementation of learning using the CTL model based on islamic boarding school also proceeded well in accordance with the stages—namely, relating, experiencing, applying, cooperating, and transferring—thereby supporting a more meaningful knowledge construction process. The contribution of this study lies in the use of islamic boarding school culture as an authentic context for mathematics learning, in which the daily experiences of students serve as a source of mathematical situations for understanding concepts. This approach not only improves learning outcomes but also encourages students' active engagement in the learning process. However, this study has limitations, including a small sample size and a relatively short duration of instruction, which prevent it from fully capturing the long-term effects. Therefore, it is recommended that future research involve a larger sample, a longer study period, and the development of a pesantren-culture-based CTL model for different educational materials and levels.

Conflict of Interest

The authors declares that there is no conflict of interest.

Auhor Contributions

F.N. understood the research concept presented and was responsible for data collection and the initial drafting of the manuscript. The other authors, P.R. and A.Z.Z., contributed to the development of the theory, the design of the methodology, data analysis, and the discussion of the research results through the final revision stage. All authors confirm that they have read and approved the final version of this paper. The total percentage of contribution to the conceptualization, drafting, and refinement of the manuscript is as follows: F.N.: 40%, P.R.: 30%, and A.Z.Z.: 30%.

Data Availability Statement

The authors declare that data supporting the results of this study will be provided by the corresponding author, [F.N.], upon reasonable request.

References

- Abraham, I., & Supriyati, Y. (2022). *Desain kuasi eksperimen dalam pendidikan : literatur*. 8(3), 2476–2482. <https://doi.org/10.36312/jime.v8i3.3800/http>
- Agustian, A., Lisdiana, K., Suryana, A., & Nursalman, M. (2025). *Analisis Statistik Uji Normalitas dan Homogenitas Data Nilai Mata Pelajaran dengan Menggunakan Python*. 10(1), 51–56. <https://doi.org/10.54801/b2726673>
- Apriani, F., & Sudiansyah, S. (2024). *Dampak Kurangnya Praktik Dalam Pelajaran Matematika: Pentingnya Latihan Terstruktur Bagi Pemahaman Konsep Matematika*. *AL KHAWARIZMI: Jurnal Pendidikan Matematika*, 4(1), 40-49. 4(1). <https://doi.org/10.46368/kjpm.v4i1.1856>
- Aprilia, T. (2021). *Efektivitas Penggunaan Media Sains Flipbook Berbasis Kontekstual untuk Meningkatkan Kemampuan Berfikir Kritis Siswa* *The Effectiveness of the Use of Flipbook Science Media Based on Contextual to Improve Critical Thinking Ability of Students*. 14(1), 10–21. <https://doi.org/10.21831/jpipfip.v14i1.32059>
- Arifin, C. S., & Nuh, M. (2026). *Eksplorasi kemampuan literasi matematis siswa pada perbandingan senilai : studi kasus berbasis*. 11(1), 130–143. <https://doi.org/10.26877/jipmat.v11i1.3684>
- Bolo, K., Konsep, P., & Aljabar, M. (2025). *Pengaruh Model Pembelajaran Concept Attainment terhadap Pemahaman Konsep Matematika Siswa Kelas VII*. 5, 745–761. <https://doi.org/10.53299/jagomipa.v5i3.2116>
- Dayani, D. R., & Hasanuddin, H. (2020). *Pengaruh Penerapan Model Pembelajaran Contextual Teaching and Learning (CTL) terhadap Kemampuan Pemecahan Masalah Matematis berdasarkan Self Confidence Siswa SMP Negeri 1 Sungai Batang*. *JURING (Journal for Research in Mathematics Learning)*, 3(1), 091. <https://doi.org/10.24014/juring.v3i1.8896>
- Effendy, I. (2016). *Pengaruh pemberian pre-test dan post-test terhadap hasil belajar mata diklat hdw.dev.100.2.a pada siswa smk negeri 2 lubuk basung*. <http://dx.doi.org/10.30870/volt.v1i2.2873>
- Fitriana, D. A. (2022). *Validitas Dan Reliabilitas Instrumen Penilaian Matematika Dengan Problem Solving Berbasis Penskoran Politomus*. 5(1), 13–25. <https://doi.org/10.61941/iklila.v9i1>
- Kholil, M., & Safianti, O. (2019). *Efektivitas Pembelajaran Penemuan Terbimbing Terhadap Hasil Belajar Matematika Siswa Materi Barisan dan Deret*. 89–98. <https://doi.org/10.31537/laplace.v2i2.246>
- Kiareni, C. L., & Sorisa, C. (2024). *Analisis Penerapan Distribusi Sampling terhadap Kualitas Informasi dan Kepuasan Pengguna Media Sosial*. 2(6), 560–564. <https://doi.org/10.61722/jssr.v2i6.3004>
- Kriswinarso, T. B., Sugianto, L., & Bachri, S. (2023). *Pemahaman konsep siswa : eksperimen pada siswa smp dengan pembelajaran matematika berbasis kooperatif tipe conceptual understanding procedures (CUPS)*. 10–18. <https://doi.org/10.53696/2964-867X.76>
- Pranata, E. (2016). *Implementasi Model Pembelajaran Group Investigation (GI) Berbantuan Alat Peraga Untuk Meningkatkan Kemampuan Pemahaman Konsep Matematika*. 34–38. <http://dx.doi.org/10.26737/jpmi.v1i1.80>
- Pratama, R. A., & Saregar, A. (2019). *Pengembangan lembar kerja peserta didik (lkpd) berbasis scaffolding untuk melatih pemahaman konsep*. 02(1), 84–97. <https://doi.org/10.24042/ij sme.v2i1.3975>
- Putri, I., Nurkifayati, Lisfani, Inayah, A., & Syafruddin. (2025). *Penerapan Model*



- Pembelajaran CTL Berorientasi Kearifan Lokal untuk Meningkatkan Hasil Belajar Siswa SD*. 2(2), 2014–2019. <https://doi.org/10.71436/jpi.v2i2.33>
- Rahmawati, S. M., Sutarni, N., & Muhammad, I. (2023). *Meningkatkan Kemampuan Berpikir Kritis Siswa melalui Model Contextual Teaching and Learning : Quasi-Eksperimen*. 4, 969–976. <https://doi.org/10.62775/edukasia.v4i2.378>
- Ratnawati, & Romansyah, R. (2022). *Analyzing efl classroom interaction in contextual teaching and learning*. 9(2), 164–176. <https://doi.org/10.22219/celtic.v9i2>.
- Ruwaitah, R. (2022). Penggunaan Strategi Pembelajaran CTL (Contextual Teaching and Learning) untuk Meningkatkan Prestasi Belajar Mata Pelajaran Matematika Materi Relasi dan Fungsi pada Siswa Kelas X MIPA-2 SMAN 4 Kota Bima Semester 1 Tahun Pelajaran 2019/2020. *Jurnal Pendidikan Dan Pembelajaran Indonesia (JPPI)*, 2(2), 87–99. <https://doi.org/10.53299/jppi.v2i2.220>
- Safari, Y., & Nurhida, P. (2024). Pentingnya Pemahaman Konsep Dasar Matematika dalam Pembelajaran Matematika. *Karimah Tauhid*, 3(9), 9817–9824. <https://doi.org/10.30997/karimahtauhid.v3i9.14625>
- Siswanto, D. H., Kintoko, K., & Pisiwati, S. A. (2025). Integrasi CTL dan Etnomatematika dalam Pembelajaran Matematika untuk Pemahaman Konseptual Berbasis Budaya. *SIGMA DIDAKTIKA: Jurnal Pendidikan Matematika*, 13(2), 113–124. <https://doi.org/10.17509/sigmadidaktika.v13i2.81536>
- Sitanggang, V. S., & Simanjorang, M. M. (2025). *Investigasi Peningkatan Kemampuan Pemahaman Konsep Matematis Siswa dalam Kelas Pembelajaran dengan Pendekatan Pendidikan Matematika Realistik*. 5, 1549–1559. <https://doi.org/10.53299/jagomipa.v5i4.2779>
- Suhermi, L., Barokah, N., & Kamal, R. (2024). Pembelajaran Kontekstual sebagai Inovasi Kreatif dalam Menjadikan Materi Ajar Lebih Bermakna. *JISPENDIORA: Jurnal Ilmu Sosial, Pendidikan Dan Humaniora*, 4(2), 94–103. <https://doi.org/10.56910/jispendiora.v4i2.2197>
- Sulastri, A. (2016). Penerapan Pendekatan Kontekstual Dalam Siswa Sekolah Dasar. *Jurnal Pendidikan Sekolah Dasar*, 1(1), 156–170. <https://doi.org/10.17509/jpgsd.v1i1.9068>
- Wathoni, N. (2024). *Penggunaan media konkret dalam pembelajaran konsep matematika abstrak*. 101–105. <https://doi.org/10.61116/jiim.v2i4.484>
- Yanti Siregar, E., Holila, A., Putra Nasution, D., Pendidikan MIPA, F., Pendidikan Tapanuli Selatan, I., Matematika, G., Negeri, S., Kunci, K., Kontekstual, P., Belajar, M., & Konsep, P. (2020). Penerapan pendekatan kontekstual dalam upaya meningkatkan motivasi belajar dan kemampuan pemahaman konsep matematika siswa. *Jurnal Education and Development*, Vol. 8 No.(4), 370–377. <https://doi.org/10.37081/ed.v8i4.2136>

Authors Biography



Firda Novita Muharromah is a student in the Mathematics Education Program, Faculty of General Education, Zainul Hasan Genggong Islamic University, Indonesia.

✉ mfirdanovita@gmail.com

	<p>Poppy Rachman is the Vice Rector III at Zainul Hasan Genggong Islamic University, Indonesia. ✉ poppyrachman.inzah@gmail.com</p>
	<p>Athar Zaif Zairozie is a tenured lecturer in Mathematics Education at the Faculty of General Education. Email: ✉ zaif.athar@gmail.com.</p>