Mathematics Research and Education Journal
Vol 10, No 1, Page 43-54, April 2026
Doi: 10.25299/mrej.2026.vol10(1).26838
Learning Method I Research Article OPEN ACCESS

Improving Students' Learning Interest Through the Contextual Teaching and Learning (CTL) in Geometry

Junianto*[1], Katon Agung Ramadhan[1], Aulia Fonda[1], Muh Wildanul Firdaus [1]
, Nur Hidayat Pamungkas
[1]Mathematics Education Study Program, Faculty of Education and Humanities (FPH) Universitas Islam Mulia Yogyakarta
*junianto@uim-yogya.ac.id

ABSTRACT

Low student interest remains a persistent issue in mathematics education. This study investigated the effectiveness of the Contextual Teaching and Learning (CTL) approach in enhancing students' interest in learning mathematics. The research involved all students from a public junior high school in Yogyakarta, Indonesia. Using a quasi-experimental design, two eighth-grade classes were selected as the experimental and control groups, with 34 students in each class. Data were collected through a learning-interest questionnaire and classroom observations. The questionnaire employed a Likert scale and was administered before and after the treatment. Instrument validity was examined using the Pearson Product Moment correlation, while reliability was tested through Cronbach's Alpha. The findings indicated that CTL significantly improved students' learning interest compared with the conventional expository approach. Students in the experimental class showed greater enthusiasm, participation, and engagement during mathematics lessons because the learning activities were connected to real-life situations and meaningful experiences. Statistical analysis using a one-sample t-test and an independent-sample t-test at a 5% significance level confirmed that the increase in learning interest among students taught through CTL was significantly higher than that of students taught through expository instruction.

ARTICLE HISTORY

Received 01 January 2026
Revised 1 March 2026
Accepted 2 April 2026

KEYWORDS

Contextual Teaching and Learning; Geometry; Students' Learning Interest

SUBJECT

Learning Method, Classroom Teaching, Learning Results

1. Introduction

The learning of mathematics in schools is highly important because it has a direct impact on students' academic performances [1]. In addition, academic achievement also important because it is commonly viewed as a crucial determinant of students' future career success [2]. Mathematics holds a vital place in human life, serving not only as a key component for academic success but also as a practical tool for solving real-world problems, including financial decision-making, managing time, and understanding spatial relationships [3]. Students' academic performance is regularly evaluated as a measure of the effectiveness and quality of education provided in schools. Students' learning interest significantly influences their learning performaces. The greater students' learning interest in a subject, the higher their motivation to engage in more diligent study, which ultimately contributes to improved students' academic performance, including examination scores in that subject [4].

The reliance on expository methods is partly influenced by an education culture that prioritizes exam results over the learning process itself. This makes it difficult to place blame on individual teachers, as the system is still evolving to find approaches better suited to Indonesian students. However, this method contributes to low student interest in learning, as students tend to be passive during lessons. According to interviews, teachers reported that students still showed limited enthusiasm and motivation during mathematics classes, which was also reflected in their final learning outcomes. This situation highlights the need for more diverse teaching strategies ones that actively involve students and help nurture their interest in mathematics learning. Interviews with mathematics teachers further confirmed that students' learning interest in mathematics remains low, as seen in their lack of engagement during group activities.

Observations and interviews as a preliminary study at a junior high school in Yogyakarta showed that mathematics instruction is still predominantly conducted using expository methods. Teaching tends to follow a teacher-centered model, where the teacher remains the main source of information [5]. This approach has long been embedded in Indonesia's educational culture, as it is widely used across many institutions. While effective for delivering information, it is less successful in fostering deep or meaningful understanding. Because it prioritizes teacher explanations over student exploration, it does not support independent idea development as emphasized in constructivist learning theory. In contrast, student-centered learning has been shown to improve learning outcomes [6], [7] . Thus, one of the crucial factors in a school's success in attaining its educational objectives is the application of innovative teaching methods that are tailored to students' needs [8].

To overcome these challenges, a teaching approach that can strengthen students' learning interest is needed. Several instructional strategies can promote student engagement, and one effective method is the Contextual Teaching and Learning (CTL) approach. CTL is an instructional model that encourages students to actively explore learning materials and relate them to real-world contexts for enhancing the quality of education at the senior high school [9], [10][11]. Active engagement in the learning process can strengthen students' learning interest and support their problem-solving abilities. Prior studies have also shown that CTL positively influences students' learning interest [12]. Students' learning interest also have a direct impact on optimizing learning outcomes [4], [7]. Geometry is known as one branch of mathematics that has concrete objects and is close to everyday life. Therefore, the material chosen in this research is triangles and the Pythagorean theorem, which is a branch of geometry at the junior high school level. It also helps students apply mathematical concepts in everyday situations [13].

Given this background, the purpose of the present study is to investigate the effectiveness of the Contextual Teaching and Learning (CTL) approach in improving students' learning interest. The findings of this research are intended to provide additional insights for educators and to offer alternative instructional strategies aimed at increasing students' learning interest in mathematics.

A student's learning interest in learning is a pivotal determinant of academic achievement. Learning interest is a very important factor in students' academic success [14]. Conceptually, interest is characterized as an internally driven sense of pleasure and affinity for an activity [12]. In the context of education, it manifests as the motivation to participate in learning, fueled by the positive affect derived from the process itself [15], or alternatively, as the volition to engage stemming from personal enjoyment and a genuine attraction to the

academic task [16]. Students' learning interest can be described as an individual's inclination to engage in learning, driven by focused attention, intellectual curiosity, feelings of pleasure, enthusiasm, and a genuine attraction to subjects perceived as personally valuable [17]. Consequently, this research employs three key indicators to assess students' learning interest: their level of attention, sense of curiosity, and degree of enjoyment during mathematics instruction. Factors such as the teacher's role, learning resources, the family environment, and the school environment influence students' interest in learning [18]. Previous finding implies that strengthening persistence, attention, and learning motivation should be a primary focus in mathematics teaching strategies [19]. Students' learning interest is influenced by uncontrolled technology use, limited social interaction, and a lack of understanding of the benefits of digital learning [20].

Implementing the Contextual Teaching and Learning (CTL) approach can effectively increase students' learning interest. Evidence suggests that CTL raises students' engagement in mathematics by demonstrating how the subject applies to and matters in daily life [21]. The effectiveness of the CTL approach is supported by multiple studies. CTL is an effective science teaching approach at the junior high level when supported by prepared teachers, adequate resources, and differentiated strategies [22]. Muliani et al. found that this constructivist method boosts students' learning interest [23]. The Contextual Teaching and Learning (CTL) approach is a teaching method that helps educators bridge classroom lessons with real-world applications [24], [25]. The CTL method is a teaching framework designed to foster active student engagement in the investigation of subject matter, emphasizing the creation of direct links between academic concepts and authentic, everyday experiences [9].

Constructivist theory, teachers are not seen as mere transmitters of knowledge, but as facilitators who guide students in constructing their own understanding [21]. Contextual Teaching and Learning (CTL) incorporates several essential components: constructivism, questioning, modeling, inquiry, learning communities, reflection, and authentic assessment[12]. This approach provides students the opportunity to independently develop and apply ideas, leading to more meaningful comprehension. Furthermore, CTL enhances problem-solving skills, a core element of mathematical literacy, making it highly relevant for developing this competency [26]. It also emphasizes the active involvement of all learners and the connection of material to real-life contexts.

The Contextual Teaching and Learning (CTL) approach is grounded in the principle that students achieve optimal learning outcomes when immersed in an educational environment that is both scientific and experiential in design. This methodology posits that learning attains greater meaning through active student participation and first-hand experience in the educational process, rather than through the passive reception of information [27]. The CTL approach offers multiple pedagogical benefits. These include fostering a more enjoyable learning atmosphere, enhancing students' awareness of their surroundings, increasing their confidence in articulating personal experiences and daily observations, and better equipping them to manage common real-world challenges [9].

Evidence from prior research indicates that the Contextual Teaching and Learning (CTL) approach is effective in elevating academic performance and strengthening problem-solving capabilities in mathematics [24], [28]. The methodology offers several pedagogical advantages, such as cultivating a more enjoyable learning environment, sharpening students' contextual awareness, building their confidence in articulating everyday observations, and enhancing their preparedness for practical life challenges [9]. Given these combined benefits,

CTL is anticipated to be a robust strategy for simultaneously increasing students' learning engagement and their mathematical literacy.

2. Methodology

Data were collected at a junior high school in Yogyakarta after initial observation and interviews with a mathematics teacher. Following a quasi-experimental quantitative design, two Grade VIII classes were sampled from the school population. This school is a state school that has A accreditation and is one of the favorite schools in the city of Yogyakarta. One class received CTL approach (experimental group), while the other was taught with the expository approach (control group). This study use pretest-posttest control group design where CTL approach represented the independent variable, and students' learning interest served as dependent variables. Contextual Teaching and Learning (CTL) approach is a teaching method that helps educators bridge classroom lessons with real-world applications. The learning strategy used in implementing CTL is REACT (relating, experiencing, applying, cooperating, transferring). Meanwhile, in assessing students' learning interests, a learning interest questionnaire is used before and after implementing CTL approach. Validity was tested using content validity and construct validity. Content validity was conducted by experts, namely mathematics education lecturers, while construct validity was assessed using Confirmatory Factor Analysis (CFA).

An observation checklist was employed to evaluate the alignment of the instructional process with the lesson plan. All research instruments underwent validity and reliability testing using Cronbach's alpha. The questionnaire consisted of 27 items derived from indicators of students' learning interest (and utilized a five-point likert scale (always, often, sometimes, rarely, and never). Table 1 displayed the indicators that used to create measurement questionnaire and Table 2 displayed the questionnaire.

Table 1. Questionnaire Indicators

Indicator	Aspect	Positive Items	Negative Items	Total Items
Attention	Mathematics Subject	-	13	1
	Learning Process	6, 17	2, 21	4
	Assignments	-	11	1
Curiosity	Mathematics Subject	3, 25	-	2
	Learning Process	1, 22	12	3
	Assignments	26	15	2
Enjoyment	Mathematics Subject	-	24	1
	Learning Process	16	23	2
	Assignments	18, 20	19	3
Attraction	Mathematics Subject	5, 7, 8, 10	4	5
	Learning Process	27	-	1
	Assignments	-	9, 14	2
Total		15	12	27

STUDENT LEARNING INTEREST QUESTIONNAIRE

Name: ....
Class: ....
Instructions for Filling Out the Questionnaire:
Please give your response by placing a check mark (√) in the column (option) that applies!
Description:
A : Always
O : Often
S : Sometimes
R : Rarely
N : Never

No	Statement	A	O	S	R	N
1	When something is unclear in math lessons, I ask the teacher.					
2	During lessons, I talk about things unrelated to the lesson.					
3	I work on math problem applications.					
4	In learning math, I don't study materials that haven't been explained yet.					
5	I learn math because I'm interested in the topic.					
6	I pay full attention during math lessons.					
7	Besides at school, I also set aside time to study math at home.					
8	After school, I review the material learned at school.					
9	I don't do the homework/tasks given by the teacher.					
10	Before attending math lessons, I review previous lessons.					
11	When I have math homework, I copy my friend's work.					
12	I don't ask the teacher or friends when I don't understand during class.					
13	I only study math when there is a test.					
14	If the homework is difficult, I don't do it even if a friend offers to help.					
15	I choose not to do assignments if they are too difficult.					
16	After lessons, I enjoy math more.					
17	I pay attention to the teacher's explanation so I don't fall behind.					
18	I don't complain when the teacher gives assignments.					
19	If I get a low score on an assignment, I don't want to redo it.					
20	I enjoy doing group assignments.					
21	I can't concentrate well during lessons.					
22	I answer the teacher's questions during lessons.					
23	I stay quiet during class discussions.					
24	I am happy when math class is canceled.					
25	Before lessons, I study the material that will be covered in school.					
26	If I have difficulty with assignments, I try to study with smarter friends.					
27	I am enthusiastic and excited during math lessons.					

Figure 2. Students' Learning Interest Questionaire

The possible scores based on the questionaire ranged from 27 as minimum score to 135 as maximum score. Table 2 summarizes the reliability testing results for the questionnaire.

Table 2. Reliability Statistic

Cronbach's Alpha	N of Items
0.861	27

The reliability analysis in Table 2 indicates that the instrument met the reliability requirement, with a Cronbach's alpha coefficient greater than 0.5. Subsequently, the results of the construct validity test using Confirmatory Factor Analysis (CFA) are presented in Table 3.

Table 3. KMO and Bartlett's Test

KMO-MSA	Bartlett's test (Chi-Square)	Sig.
0.513	630.78	0.000

Based on Table 3, the KMO-MSA value (> 0.5) indicates adequate sampling, while Bartlett's test ($\chi^2 = 630.78$; $p = 0.000$) confirms significant correlations among variables,

supporting further analysis. The results, supported by empirical data and the literature, identify five indicators that are attention, enjoyment, curiosity, enthusiasm, and attraction indicating that the questionnaire is valid.

The influence of the CTL and expository approach on students' learning interest was examined using a one-sample t-test supported by SPSS. A significance level below 0.05 was used to determine the effectiveness of the CTL and expository approach. The students' learning interest data were then converted into numerical scores based on predetermined criteria.

Table 4. Conversion Means Score of Interest

Formula	Score Interval	Categories
$\boldsymbol{x > \bar{X}i + 1.8\, Sb_i}$	$x > 113$	Very High
$\boldsymbol{\bar{X}i + 0.6\, Sb_i < x \leq \bar{X}i + 1.8 Sb_i}$	$91 < x < 113$	High
$\boldsymbol{\bar{X}i - 0.6\, Sb_i < x \leq \bar{X}i + 0.6 Sb_i}$	$70 < x < 91$	Medium
$\boldsymbol{\bar{X}i - 1.8\, Sb_i < x \leq \bar{X}i - 0.6 Sb_i}$	$48 < x < 70$	Low
$\boldsymbol{x \leq \bar{X}i - 1.8\, Sb_i}$	$x \leq 48$	Very Low

The students' learning interest scores are considered effective if the average score falls within the high category (91 < x < 113). Prior to conducting the effectiveness test, the data were first subjected to normality and homogeneity testing. Normality test was conducted using the Kolmogorov-Smirnov one-sample test, and homogeneity was examined through Levene's statistic. If both assumptions were met, the analysis continued with one sample t-test to know effectiveness each group. Independent sample test was used to compare whether the implementation of CTL approach in the experimental group was more effective than the expository approach in the control group.

3. Results and Discussion

3.1 Results

After establishing their validity and reliability, the instruments were applied to students in both the pre-intervention and post-intervention phases. The results of the pre-test and post-test measurements of students' learning interest is presented below.

Table 5. Student's Learning Interest Data

Description	Experimental group		Control group	
	Pre-test score	Post-test score	Pre-test score	Post-test score
Minimum Score	66.00	80.00	64.00	62.00
Maximum Score	116.00	124.00	130.00	125.00
Sum Statistic	3008.00	3543.00	3057.00	3302.00
Average	88.47	104.20	89.91	97.71
Variance	100.14	164.89	257.29	218.59

The results in Table 5 reveal increases in students' learning interest score after the treatment was applied to both the experimental and control groups. This improvement is indicated by the students' score results in average, sum, minimum and maximum scores. To assess the effectiveness of the instruction, additional analyses were required. The analysis began with assumption testing, which included normality and homogeneity tests. Normality was assessed through the calculation of Kolmogorov-Smirnov one-sample test, and homogeneity was examined through Levene's statistic.

Table 6. Normality Test Results

Group	Data	Mean	Sig (2-tailed)
Experimental Group	*Pre-test*	88.47	0.20
	Post-test	104.20	0.10
Control Group	*Pre-test*	88.91	0.15
	Post-test	97.11	0.20

Table 7. Homogeneity Result

Levene Statistic	Sig.
3.684	0.059

The findings in Table 6 reveal that the significance value is less than 0.05, which indicates a significant correlation and implies that the data were drawn from a normally distributed sample. A significance value of homogeneity test in Table 7 above 0.05 in the Levene Statistic indicates that the homogeneity of variances assumption was fulfilled for the pre-test and post-test data. With the assumptions met, the analysis then proceeded to examine the effectiveness of the instruction to know whether both approaches can improve students' learning interest or not. The effectiveness of the two approaches is demonstrated by the results of the following one-sample t-test.

Table 8. One Sample T-test Result

	Mean Difference	Sig. (2-tailed)
Experimental group	15.73	0.002
Control group	7.80	0.032

As presented in Tables 8, the significance values are less than the alpha threshold of 0.05, resulting in the rejection of H_0. This finding suggests that both instructional approaches effectively improve students' learning interest. Subsequently, a comparative effectiveness analysis between the two groups was performed to identify the more effective approach. Independent sample t-test are shown below.

Table 9. Independent Sample t-test Result

Score	t	Mean Difference	Sig. (2-tailed)
Equality of Means' test	2.11	6.49	0.0184

As presented in Table 8, the significance value is less than the alpha threshold of 0.05, resulting in the rejection of the null hypothesis. These results suggest that the CTL approach has a greater impact than the expository approach on improving students' learning interest.

3.2 Discussion

The results reveal that the CTL approach exerted a strong influence on both learning interest, in line with previous research [12]. It is indicated the effectiveness of REACT (relating, experiencing, applying, cooperating, transferring) strategy in CTL learning process. Students were organized into six small groups. During the relating and experiencing stages, students demonstrated increased enthusiasm for learning geometry as they engaged with concrete real-life geometric objects, fostering awareness of the relevance of mathematics in everyday contexts. In the cooperating stage, students actively exchanged ideas and participated in group discussions, which enhanced curiosity and promoted enjoyment of the

learning process. Finally, in the transferring stage, students exhibited greater interest through presentations and question-and-answer sessions with other groups. Contextual problems in geometry, particularly those involving the Pythagorean concept, such as determining the shortest travel route and the height of a building when presented through group discussions, were found to enhance students' enthusiasm, as they are directly related to real-life situations.

Analysis of the pre-test scores homogeneity is 0.052 more than alpha (0.05) that indicate no differences in initial ability between the two groups. Following the intervention, students in the experimental group obtained higher average scores than those in the control group, with increases of 6.49 points in students' learning interest. Statistical analysis using SPSS further confirmed the effectiveness of the CTL approach.

The findings demonstrate that the CTL approach is more effective in improving students' learning interest due to its emphasis on contextual problem-solving. Geometry problems, particularly those related to the Pythagorean theorem, were connected to real-life situations. This contextualization was shown to increase students' learning interest in geometry, as students indirectly became aware of the practical applications of geometric concepts in everyday life. Students became more motivated to learn geometry as they understood the usefulness of the material through its application in everyday life. The results of previous study indicate that there is a mutually influential relationship between students' learning interest and their learning outcomes [29].

The integration of contextual problems enables students to better understand the relevance and practical value of mathematical concepts, thereby increasing their learning interest. Enhanced interest promotes active engagement in group discussions, allowing students to construct knowledge through peer interaction. As a result, learning becomes student-centered, positioning students as active agents in the learning process [6]. Conversely, the expository approach used in the control group emphasizes teacher-centered instruction, which limits student participation and reduces opportunities for collaborative learning.

Previous studies have consistently shown that the Contextual Teaching and Learning (CTL) approach is effective in increasing students' learning interest [12] [30] [31]. In addition, students' learning interest has been reported to improve through differentiated learning strategies [32]. Research by Junianto and Wutsqa further demonstrated that CTL is more effective than Problem-Based Learning (PBL) in enhancing students' learning interest [13].

These findings are consistent with the results of the present study. Although Sawitri et al. examined different learning outcomes, their study similarly confirmed a positive effect of CTL on students' learning interest using t-test analysis (Sawitri et al., 2024).Likewise, Iim et al. reported increased students' learning interest through differentiated learning based on PBL, which shares similarities with CTL in emphasizing real-world, contextual problems [32]. Furthermore, the comparative study by Junianto and Wutsqa revealed that CTL produced significantly better outcomes than PBL in improving students' learning interest [13]. Overall, prior research provides strong empirical support and aligns closely with the findings of this study. However, a limitation of this study is that the sample and population sizes need to be expanded to better determine the broader effectiveness of CTL

4. Conclusion

This study demonstrates that both the Contextual Teaching and Learning (CTL) and expository approaches effectively improve students' learning interest. Nevertheless, the CTL

approach yields greater benefits due to its emphasis on student-centered learning, active engagement, and collaborative discussion. By encouraging students to construct knowledge independently and positioning teachers as facilitators, CTL fosters higher learning interest and deeper conceptual understanding. The findings further indicate that the application of appropriate pedagogical strategies and active student involvement are critical to achieving learning success. In particular, the integration of real-life contextual problems (a core feature of CTL) has been shown to significantly improve students' learning interest compared to the expository approach.

This study was limited to a single school and focused on specific mathematical topics (geometry), which may restrict the generalizability of the findings. Future research could involve a larger sample size, different educational levels, or diverse mathematical content to provide broader insights. Additionally, further studies may explore the long-term impact of CTL on students' learning interest, as well as its integration with digital or technology-enhanced learning environments.

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