

THE EFFECT OF THE CULTURALLY RESPONSIVE TEACHING (CRT) APPROACH ON THE MATHEMATICS LEARNING OUTCOMES IN ELEMENTARY SCHOOL

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ABSTRACT

This study aims to determine the effect of the Culturally Responsive Teaching (CRT) approach on the mathematics learning outcomes of third-grade students at SDN 2 Planggu. The CRT approach is a teaching approach that emphasizes the importance of integrating students' cultural backgrounds into the learning process. This study employed a quantitative research design with a quasi-experimental design. The sample for this study consisted of 19 third-grade students from SDN 2 Planggu as the experimental class and 20 third-grade students from SDN 1 Canan as the control class. The results of this study indicate that, based on the descriptive analysis of the experimental class, the average pretest learning outcomes were 65.65 and the posttest 86.05, meaning there was an improvement in students' mathematics learning outcomes using the CRT approach. Based on the descriptive analysis of the control class, the average pretest score was 59.05, and the posttest score was 79.12, indicating an improvement in students' mathematics learning outcomes using the TPACK approach. Based on the results of the Independent Samples t-Test, the significance value (Sig., two-tailed) was $0.003 < 0.05$, meaning H_0 is rejected, and H_a is accepted. Thus, it can be concluded that the CRT approach has an effect on students' mathematics learning outcomes. As the average learning outcomes in the experimental class using the CRT approach were 86.05, and in the control class using the TPACK approach were 79.12, this indicates that there is a difference in mathematics learning outcomes between the CRT and TPACK approaches in third-grade elementary school.

Keyword: Culturally Responsive Teaching, learning outcomes, mathematics

INTRODUCTION

Education is a series of deliberate efforts to enhance one's potential. Through education, individuals not only acquire knowledge but also develop skills that foster a positive attitude toward facing future challenges. Education is considered vital because it has the power to transform a nation lagging behind into a developed country (Rofisian et al., 2024). The function of education is to serve as a means of improving the quality of human resources and to act as the primary foundation for building a better nation. Elementary school education serves as the initial foundation for determining the direction of a child's potential development. One of the most critical stages in a child's cognitive, social, and emotional development is elementary school (Syifani et al., 2025).

As we enter the 21st century, education faces a wider range of challenges, which may prompt a shift in perspective regarding the learning process. In 21st-century education, educators are no longer the central figures in the learning process; instead, they serve as facilitators. To ensure student learning success, teachers must fulfill this role as facilitators (Fauzi & Mustika, 2022). Consequently, students are expected to gain hands-on learning experiences that can have a tangible impact on their understanding of the subject. This is particularly relevant when applied to mathematics, which is a required subject in elementary school.

Mathematics is not merely about numbers and formulas; it also guides students in developing problem-solving skills and the ability to make sound decisions. Thus, a learning process in which students are able to be directly involved in problem-solving will have a positive impact on their

understanding and ability to make sound decisions. However, in reality, mathematics education still faces many challenges. Mathematics education presents unique challenges for students (Sholikah & Murtiyasa, 2025). One of these is the challenge of increasing students' interest in and achievement in mathematics.

The quality of instruction is a factor that can lead to a lack of interest and poor learning outcomes among students. The lack of meaningfulness in the teaching approaches used by educators, as well as the absence of a connection between learning and daily life, results in students having a poor understanding of mathematical concepts. Mathematics curriculum content is often taught abstractly without relating it to students' real-life experiences.

Based on observations conducted by the researcher on September 23, 2025, at SDN 2 Planggu, it was found that the teaching approach used during the learning process did not sufficiently emphasize the students' cultural engagement and real-world experiences. As a result, students struggled to understand abstract mathematical concepts. Additionally, it was found that learning activities were still predominantly based on textbooks and modules as teaching materials. This led to a lack of interest among students during the learning process, causing them to perceive mathematics as a boring subject. Furthermore, due to their lack of understanding of the taught material, students viewed mathematics as a difficult subject.

One educational approach that can be used to address these issues is Culturally Responsive Teaching (CRT). Culturally Responsive Teaching integrates local culture or customs into the learning process (Taher, 2023). CRT is a pedagogical approach that connects learning to students' cultural engagement, identity, and experiences in the learning process. Implementing the CRT approach is crucial because it creates a relevant and meaningful learning environment, thereby helping to instill the cultural values present in the students' surroundings.

Based on these issues, the researcher was motivated to conduct a study titled "The Effect of the Culturally Responsive Teaching Approach on the Mathematics Learning Outcomes of Third-Grade Students at SDN 2 Planggu". This study was conducted in third-grade elementary school classes, which are in a critical phase of cognitive development. Additionally, this study focuses on the implementation of the CRT approach in public elementary school settings, which typically have more diverse cultural backgrounds. This research aligns with the direction of the Merdeka Curriculum policy, which emphasizes inclusive, student-centered learning and responsiveness to cultural contexts. This study is expected to provide an overview of the extent to which the CRT approach can influence mathematics learning outcomes in third-grade elementary school. Furthermore, the results of this study are expected to serve as a reference for educators in creating more contextual and meaningful mathematics learning experiences.

LITERATURE REVIEW

The Culturally Responsive Teaching Approach

The Culturally Responsive Teaching (CRT) approach is a teaching approach that integrates students' cultures and life experiences into the learning process. According to Navitri et al. (2025), "CRT is a pedagogical approach that emphasizes the importance of integrating students' cultural identities into the learning process." Zakiyah (2023) argues that there are stages in the CRT approach, namely: a) Self-identification: At this stage, educators gather information about students' cultural backgrounds and learning styles., b) Cultural understanding: At this stage, students gain an understanding of culture by exploring various sources of information about their cultural backgrounds, c) Collaboration, at this stage, educators can use various learning strategies to encourage students to actively participate in discussions, d) Critical reflection, at this stage, educators help develop thinking skills that take into account the students' characteristics, e) Transformative construction, at this stage, students build understanding based on the experiences they have gained.

Every learning approach has its own strengths and weaknesses in the learning process, and the CRT approach is no exception. According to Nufus et al. (2024), the strengths of the CRT

approach include the following: (a) Creating a welcoming environment by making students feel valued, recognized, and able to contribute in ways that reflect their cultural identities, (b) Fostering students who are actively engaged, interacting, and collaborating with their peers. (c) Students can develop 21st-century skills, (d) Creating a learning environment that encourages active participation, facilitates effective communication, and fosters critical thinking. According to Naura et al. (2025), CRT has several drawbacks, including the following: (a) Educators’ lack of understanding of CRT, (b) Lack of diverse resources, meaning learning materials such as teaching materials, references, instructional media, and assessments, (c) Bias in the curriculum and assessment, meaning that education emphasizes the dominant cultural perspective, (d) Resistance from educators, parents, and institutions, meaning a lack of understanding, fear of change, or differing viewpoints, and (e) Challenges in managing classroom diversity, meaning that classes composed of students from different cultural backgrounds require specific strategies.

Learning Outcomes

Education is a process designed to develop students’ potential through targeted learning activities. Through the learning process, each student is expected to undergo behavioral changes as an achievement of educational goals. The attainment of educational goals is reflected in students’ learning outcomes. The following are definitions of learning outcomes according to experts: (a) According to Gulo (2022), learning outcomes are behavioral changes resulting from the teaching-learning process, encompassing the cognitive, affective, and psychomotor domains, (b) According to Baiti (2021), learning outcomes are changes in students’ understanding—from not understanding to understanding—achieved from the beginning to the end of the learning process, and (c) According to Yandi et al. (2023), learning outcomes are the results achieved by students after receiving instruction over a specific period of time.

Based on the opinions of experts cited above, it can be concluded that learning outcomes represent changes in students’ abilities acquired after participating in the learning process. These changes reflect the extent to which students have achieved the learning objectives previously designed by educators. Learning outcomes reflect not only students’ abilities in the cognitive domain but also in the affective and psychomotor domains. Thus, learning outcomes serve as a key indicator of students’ success and a measure of the effectiveness of the learning process.

METHODOLOGY

This research is a quantitative study using an experimental method, which involves applying a specific treatment to a subject and examining its effects. The research design employed is quasi-experimental. Specifically, a nonequivalent control group design was used. In this design, both the experimental and control groups were administered pretests and posttests to measure students’ learning outcomes before and after the treatment. The following are the stages of the research, as illustrated in the table below:

Figure 1: Research Design

Group	Pretest	Treatment	Posttest
E	T1	X	T2
K	T1	Y	T2

Notes:

E: Experimental Group

K: Control Group

X : Treatment using the CRT approach

Y : Treatment using the TPACK approach

T1 : Pretest (initial test before treatment)

T2 : Posttest (final test after treatment)

This design is known as the pretest-posttest control group design. Both classes were given a pretest (T1); subsequently, the experimental class received treatment (X) and the control class received a different treatment (Y). After that, both classes were given a posttest (T2). The purpose of this was to determine the difference in learning outcomes between the experimental group (E) and the control group (K) after the treatments were administered.

According to Sugiyono (2023), a population is a set of objects or subjects that share specific characteristics and serve as the basis for generalization. The population in this study consists of all third-grade students at SD Negeri 2 Planggu (19 students) and all third-grade students at SD Negeri 1 Canan (20 students). The sampling technique used in this study is a saturated sample, because the population size is limited, so all students were used as the sample. The sample in this study consists of all 19 third-grade students at SD Negeri 2 Planggu and all 20 third-grade students at SD Negeri 1 Canan.

Instruments in a study play a crucial role because they are used to measure students' abilities. The researcher assessed learning outcomes using two types of test instruments: a pretest and a posttest. The pretest was administered to both the experimental and control classes to determine students' learning outcomes before the intervention. The experimental class received instruction using the CRT approach, while the control class received instruction using the TPACK approach. The posttest was administered to assess students' learning outcomes after the intervention. This test instrument consisted of 10 multiple-choice questions, 10 short-answer questions, and 5 essay questions.

Data collection was conducted through the tests, which were then analyzed using statistical tests. The statistical tests in this study included validity tests, reliability tests using Cronbach's Alpha, normality tests using the Shapiro-Wilk test, and homogeneity tests. To determine the significance of differences in learning outcomes, an Independent Samples t-Test was used.

RESULT AND DISCUSSION

Research Findings

This study was conducted with third-grade students at SD Negeri 2 Planggu, Trucuk Subdistrict, Klaten Regency, as the experimental class, and third-grade students at SD Negeri 1 Canan, Wedi Subdistrict, Klaten Regency, as the control class during the 2025/2026 school year. The purpose of this study was to analyze the effect of the Culturally Responsive Teaching (CRT) approach on students' learning outcomes in the topic of angles in the plane in the mathematics subject. This study employed an experimental research design with a quasi-experimental approach. In its implementation, there were two class groups: the experimental class and the control class. The experimental class received instruction using the CRT approach, while the control class received instruction using the TPACK approach.

Before the test instruments were used in the study, a pilot test was conducted to assess the validity of the test items. The pilot test was administered to 20 third-grade students who served as research subjects to determine the extent to which each test item had a significant correlation with the total score. Following the pilot test of the test instruments, the next step was to conduct a validity analysis to determine the extent to which the test items were able to measure what they were intended to measure.

The results of the analysis of the 10 multiple-choice questions showed significance levels ranging from 0.003 to 0.047, with correlation coefficients ranging from 0.461 to 0.651. For the short-answer questions, 10 items showed significant values ranging from 0.003 to 0.029, with correlation coefficients ranging from 0.501 to 0.651. Meanwhile, 5 essay items had significance values ranging from 0.010 to 0.038, with correlation coefficients ranging from 0.480 to 0.573. All items on the pretest and posttest were deemed valid because they had significance values below 0.05 with a calculated r greater than the table value of 0.444. Thus, it can be concluded that the entire set of items, consisting of 10 multiple-choice questions, 10 fill-in-the-blank

questions, and 5 essay questions, met the validity criteria and is suitable for use as an evaluation instrument in this study.

Furthermore, to determine the extent to which the instrument used exhibits consistency, a reliability test was conducted using Cronbach’s Alpha. The results showed that the multiple-choice items achieved a Cronbach’s Alpha of 0.757, which falls within the reliable category, as it exceeds 0.70. The short-answer items also achieved a Cronbach’s Alpha of 0.757, which is similarly classified as reliable. The essay questions yielded a Cronbach’s Alpha of 0.863, which falls within the reliable category. Thus, all items used in the research instrument in this study possess a good level of consistency and are suitable for measuring learning outcomes.

To assess the cognitive abilities of students in each class, written tests were administered both before the intervention (pretest) and after the intervention (posttest). The questions given to the students were validated test items. The test results for both classes are as follows:

Table 1: Description of Pre-test and Post-test Learning Outcomes

	Descriptive Statistics				
	N	Minimum	Maximum	Mean (Rata-rata)	Std. Deviation
Pretest Experimental	19	57,50	77,50	65,65	5,82
Posttest Experimental	19	77,50	95,00	86,05	5,35
Pretest Control	20	50,00	72,50	59,05	5,88
Posttest Control	20	62,50	95,00	79,12	8,04

(Source: Researchers 2026)

Based on the data above, it was found that the average pretest learning achievement in the experimental class was 65.65, while that in the control class was 59.05. After the intervention, the average posttest learning achievement in the experimental class was 86.05, while that in the control class was 79.12. These data illustrate the learning outcomes achieved by students from the two different class groups. The experimental class was the group that received instruction using the CRT approach, which incorporates cultural elements into the learning process, while the control class was the group that received instruction using the TPACK approach. Before testing the hypotheses, prerequisite tests were conducted, namely normality and homogeneity tests. The results of the normality test for the pretest-posttest learning outcomes in the experimental and control classes are presented in the following table:

Table 2 Results of the Normality Test

	Class	Tests of Normality					
		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
learning outcomes	Pretest Experimental	,150	19	,200*	,941	19	,275
	Posttest Experimental	,138	19	,200*	,940	19	,268
	Pretest Control	,151	20	,200*	,952	20	,401
	Posttest Control	,105	20	,200*	,976	20	,865

(Source: Researchers 2026)

Based on the results of the normality test using the Shapiro-Wilk test—a commonly used normality test technique for small to medium-sized samples—the pretest data for the experimental class showed a significance value of 0.275 > 0.05, and the posttest results for the experimental class showed a significance value of 0.268 > 0.05. Meanwhile, the pretest results for the control class showed a significance value of 0.401 > 0.05, and the posttest results for the control class showed a significance value of 0.865 > 0.05. Thus, it can be concluded that the data from both groups, for both the pretest and posttest, are normally distributed.

The next analysis was the homogeneity test, which aimed to determine whether the data from the two groups—the experimental class and the control class—exhibited a significant level of

similarity. The results of the pretest homogeneity test for the experimental and control classes are presented in the following table:

Table 3 Results of the Pretest Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistic	df 1	df2	Sig.
learning outcomes	Based on Mean	,029	1	37	,865
	Based on Median	,036	1	37	,851
	Based on Median and with adjusted df	,036	1	36,867	,851
	Based on the trimmed mean	,042	1	37	,839

(Source: Researchers 2026)

Based on the table above, the results of the homogeneity test for the pretest scores of the experimental and control classes in the “Based on Mean” column show a significance value of $0.865 > 0.05$. Therefore, it can be concluded that the pretest data for the experimental and control classes are homogeneous or similar. Thus, both groups have equivalent initial conditions, so that differences in results during the posttest can be more reliably attributed to the treatment administered, rather than to differences in students’ initial abilities. Next is the homogeneity test for posttest learning outcomes; the test results are presented in the following table:

Table 4 Results of the Posttest Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
learning outcomes	Based on Mean	1,684	1	37	,202
	Based on Median	1,688	1	37	,202
	Based on Median and with adjusted df	1,688	1	32,120	,203
	Based on the trimmed mean	1,682	1	37	,203

(Source: Researchers 2026)

Based on the table above, the posttest results for both classes in the “Based on Mean” column show a significance value of $0.202 > 0.05$. Therefore, it can be concluded that the posttest data for the experimental and control classes are homogeneous or similar. Thus, the posttest data from both classes have met the assumption of homogeneity, making them suitable for further analysis, as both groups come from samples with equal variances and have relatively equivalent initial abilities.

The next step in data processing is to conduct a hypothesis test. The hypothesis test in this study uses the Independent Samples t-Test. This test aims to determine whether there is a significant effect on learning outcomes between the experimental and control classes after the intervention. The hypotheses in this study consist of H_0 (the CRT approach does not affect learning outcomes) and H_a (the CRT approach has an effect on learning outcomes). The Independent Samples t-Test is used to compare the mean learning outcomes of the two groups. If the Sig. (2-tailed) value is < 0.05 , then there is a significant difference, indicating that the CRT approach has an effect on students’ learning outcomes. The results of the test are presented in the following table:

Table 5 Results of the Independent Samples t-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2- tailed)
learning outcomes	Equal variances assumed	1,684	,202	3,149	37	,003
	Equal variances not assumed.			3,181	33,240	,003

(Source: Researchers 2026)

Based on the analysis of the independent samples t-test, the posttest learning outcomes showed a significance value of $0.003 < 0.05$. Thus, it can be concluded that H_0 is rejected and H_a is accepted, meaning that there is a significant effect on mathematics learning outcomes resulting from the implementation of the Culturally Responsive Teaching (CRT) approach among third-grade students at SDN 2 Planggu.

DISCUSSION

This study was conducted with the aim of conducting an in-depth analysis of the impact of the Culturally Responsive Teaching (CRT) approach on students' learning outcomes regarding angles on a plane in mathematics. This study focused on third-grade students at two elementary schools: SD Negeri 2 Planggu as the experimental class and SD Negeri 1 Canan as the control class, during the 2025/2026 academic year. In its implementation, this study employed a quasi-experimental design with a quantitative approach, involving two learning groups as research subjects.

The first group, the experimental group, applied the Culturally Responsive Teaching (CRT) approach, which emphasizes the involvement of students' culture, identity, and experiences in the learning process. This aligns with the views of Navitri et al. (2025), who state that the CRT approach is a pedagogical approach that emphasizes the importance of integrating students' cultural identities into the learning process. Meanwhile, the second group, the control group, implemented the Technological Pedagogical Content Knowledge (TPACK) approach. To obtain comprehensive and accurate data regarding the impact on student learning outcomes, this study collected data through several instruments: a pretest to assess students' initial abilities, a posttest to measure improvements in learning outcomes following the intervention, and observations to evaluate students' activities and engagement during the learning process.

The initial data for the students showed that the experimental class had a pretest mean of 65.65 with a standard deviation of 5.88, while the control class had a pretest mean of 59.05 with a standard deviation of 5.88. This indicates that the students' initial abilities were relatively similar, and the Shapiro-Wilk normality test showed that both classes were normally distributed. After the intervention, the posttest mean for the experimental class increased to 86.05 with a standard deviation of 5.35, while the posttest mean for the control class was 79.12 with a standard deviation of 8.04. The results of the normality test and the homogeneity of variances test indicated that the posttest data met the requirements for parametric statistical analysis.

To assess whether there was a significant difference in learning outcomes between the experimental class using the CRT approach and the control class using the TPACK approach, the researcher analyzed the data using the Independent Samples t-Test. This test was used because the two groups being compared were independent of each other but shared similar characteristics. The test results showed that the significance value (Sig., two-tailed) obtained was 0.003. Since this significance value is smaller than the predetermined significance threshold of 0.05, it can be concluded that there is a significant difference between the two groups. Thus,

statistically, it can be concluded that the application of the CRT approach has a significant effect on improving students' learning outcomes. This finding indicates that the CRT approach is effective in fostering students' understanding of angle concepts in the plane, as it incorporates students' cultural identities and experiences into the learning process. This aligns with the view of Yuniati & Fathoni (2025) that CRT promotes active participation, discussion, and the connection of learning materials to students' daily lives.

This is consistent with the findings of a previous study conducted by Hidayah & Nuvitalia (2025), which examined the effect of a problem-based learning model combined with a culturally responsive teaching approach on student learning outcomes in third-grade elementary school mathematics. In that study, there was a significant improvement in learning outcomes in the experimental group that received instruction using the CRT approach. This was evidenced by the average pretest score, which initially stood at 58.07, increasing to 84.43 on the posttest. This striking difference in scores indicates that the implementation of the CRT approach, which integrates students' cultural concepts and identities into the learning process, is able to encourage active student participation in understanding the material. Thus, these findings reinforce the evidence that the CRT approach can have a positive impact on student learning outcomes, particularly in mathematics at the elementary school level.

Additionally, consistent results were found in a study conducted by Erytira & Luthfisari (2024), which examined the application of the Culturally Responsive Teaching (CRT) approach on the learning outcomes of second-grade students in mathematics at SDN Palebon 02. The study found that the average student learning outcomes improved by 21% after the implementation of the CRT approach. These findings not only confirm the effectiveness of the CRT approach in improving learning outcomes but also demonstrate that this approach can be flexibly applied in any classroom, provided it is tailored to the characteristics and needs of the students.

Meanwhile, a study conducted by Fauziati & Saputra (2025), which examined the effects of the CRT, TaRL, and differentiated instruction approaches on elementary school students' mathematics learning outcomes, also yielded consistent results. The study found that average learning outcomes increased by 23.07 points, with the average pretest score of 68.46 rising to 91.53 on the posttest. This reinforces the finding that the CRT approach is adaptive and capable of making a tangible contribution to improving the quality of learning across various grade levels in elementary school.

By comparing the results of this study with three previous studies, it can be concluded that the CRT learning approach is consistent and capable of having a positive impact on student learning outcomes across various grade levels and diverse subject materials. The implementation of the CRT approach creates learning that is relevant, equitable, and meaningful, thereby enhancing a deep understanding of mathematical concepts. Thus, the use of the CRT approach has proven effective in helping students master the material optimally and improve mathematics learning outcomes at the elementary school level.

Based on the results of data analysis and discussion in this study, it can be concluded that the implementation of the CRT approach had a significant and positive effect on the learning outcomes of third-grade students regarding angles in the plane at SD Negeri 2 Planggu during the 2025/2026 academic year. This is evidenced by the increase in the average posttest scores in the experimental class, which were significantly higher than those in the control class that used the TPACK learning approach. Overall, the CRT approach has proven to be an effective learning strategy for improving conceptual understanding and mathematics learning outcomes in elementary school. Therefore, this approach is highly recommended for implementation as a meaningful and enjoyable alternative learning approach in the classroom.

CONCLUSION

Based on the results of the study conducted in the third-grade class at SD Negeri 2 Planggu, it can be concluded that the Culturally Responsive Teaching (CRT) approach in teaching angles in plane geometry significantly influenced student learning outcomes compared to the TPACK approach used in the control class. Based on the results of the descriptive analysis in the experimental class, the average pretest learning outcomes were 65.65 and the posttest 86.05, indicating an improvement in students' mathematics learning outcomes with the CRT approach. Based on the descriptive analysis of the control class, the average pretest learning outcome was 59.05, and the posttest was 79.12, indicating an improvement in students' mathematics learning outcomes with the TPACK approach.

Furthermore, based on the results of the Independent Sample t-Test on posttest learning outcomes, which showed a significance value of $0.003 < 0.05$, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_a) was accepted. This means that there is a significant difference in the average learning outcomes of students between the class using the CRT approach and the class using the TPACK approach. Thus, it can be concluded that the implementation of the Culturally Responsive Teaching (CRT) approach has an effect on the mathematics learning outcomes of third-grade students at SD Negeri 2 Planggu in the 2025/2026 academic year.

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