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THE EFFECT OF THE CULTURALLY RESPONSIVE TEACHING (CRT) APPROACH ON STUDENTS' NUMERACY ABILITY

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Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh pendekatan *Culturally Responsive Teaching* (CRT) terhadap kemampuan numerasi peserta didik. Penelitian ini merupakan penelitian kuantitatif dengan pendekatan *true-eksperimental* dengan desain *pretest-posttest control group*. Penelitian ini melibatkan pengukuran kemampuan numerasi peserta didik sebelum dan setelah perlakuan melalui tes tertulis. Data dianalisis menggunakan uji statistik *t* untuk menentukan signifikansi perbedaan kemampuan numerasi antara kelompok eksperimen dan kontrol. Hasil penelitian menunjukkan bahwa peserta didik yang mengikuti pembelajaran dengan pendekatan CRT mengalami peningkatan kemampuan numerasi yang lebih signifikan dibandingkan dengan kelompok kontrol. Temuan ini mendukung penerapan pendekatan berbasis budaya untuk meningkatkan kemampuan numerasi secara kontekstual dan inovatif.
Kata Kunci: *Culturally Responsive Teaching, Numeracy Ability, Mathematics Learning*

Abstract

This study aims to determine the effect of the Culturally Responsive Teaching (CRT) approach on learners' numeracy ability. This research is a quantitative study with a true-experimental approach with a pretest-posttest control group design. It involves measuring learners' numeracy ability before and after treatment through written tests. The data were analyzed using the t-statistical test to determine the significance of the difference in numeracy ability between the experimental and control groups. The results showed that learners who participated in learning with the CRT approach experienced a more significant improvement in numeracy ability compared to the control group. The findings support the application of a culturally-based approach to improve numeracy ability in a contextually and innovatively.
Keywords: *Culturally Responsive Teaching, Numeracy Ability, Mathematics Learning*

INTRODUCTION

The learnings of mathematics is crucial for the advancement of students' competencies, because students are invited to think critically, analytically, and creatively in solving various problems related to daily life (Argawi et al., 2021). This learning process must be carried out in a planned manner so that students can understand concepts in depth and improve their numeracy ability, which is a basic ability to understand and process various numerical information and mathematical symbols (Elsyavira et al., 2024; Maharani et al., 2023). Mathematics learning is a planned activity that requires the readiness of students' numeracy ability to receive knowledge from the material to be studied.

Numeracy is the main ability in supporting the success of students in various aspects of learning and life, so the development of this ability is very important to be done from an early age (Nurhayati et al., 2022; Yerizon et al., 2023). Numeracy ability involve the use of mathematical operations that help learners solve everyday problems and train them to think critically when making decisions. The numeracy ability indicator (Baharuddin et al., 2021; Winata et al., 2021) which refers to the Kemendikbud (2017) among others (1) Capability to apply different numbers and symbols associated with fundamental mathematics to tackle problems encountered in everyday situations, (2) Capability to evaluate information displayed in various formats (such as graphs, tables, charts, diagrams, etc.), and (3) Capability to understand the outcomes of such evaluations to make predictions and informed choices.

In addition to cognitive ability factors, the cultural diversity of students in the classroom is also a concern in the learning process (Fitriah et al., 2024). This diversity demands teaching approach that can reach different cultural backgrounds so that students feel valued and motivated in learning. Culturally Responsive Teaching (CRT) is an approach to learning that uses students' culture as the foundation for designing and implementing the learning process. This approach integrates students' cultural knowledge into the learning process to create an inclusive and relevant atmosphere (Abdalla et al., 2024; Bassey, 2016). CRT, known as culturally sensitive teaching, is an approach that combines theory and practice with the application of constructivist methods, aiming to assist students in recognizing and strengthening cultural identity, as well as appreciating the differences that exist between them (Fitriani et al., 2024; Rahmawati, 2018).

The CRT approach can be integrated with the problem-based learning (PBL) model to create more meaningful and relevant learning for students with diverse cultural backgrounds. PBL is a model that can be used to improve numeracy ability in learners (Nasoha et al., 2022). In PBL, students are encouraged to solve problems based on their knowledge and experience, thereby fostering an active and independent learning attitude. PBL is a learning method that teaches students to solve real problems, starting with providing relevant problems so that students can work in small groups to identify their knowledge and find solutions, so that students' problem-solving ability can improve (Nisa, 2023; Oktania Dewantari et al., 2022).

The application of the PBL model combined with the CRT approach has shown positive results in improving student learning outcomes, including in the aspects of mathematical literacy ability, activities, and participation, students' (Lembang et al., 2024; Mustaqfiroh et al., 2024). This model is supported by the opinion of Munna et al, (2024) that problem-based and culture-based learning can improve problem-solving ability. The results of the study show that the integration of this approach and learning model can significantly improve students' learning outcomes and help them understand the material through a relevant and culturally context-based approach. Based on this background, this research intends to assess the impact of the implementation of the CRT approach on students' numeracy ability in class X statistical materials.

METHOD

This research employs quantitative research with an approach true-experimental design pretest-posttest control group. This approach was chosen because it was able to provide a clear picture of the influence of the application of the CRT approach on students' numeracy abilities based on data obtained through pre- and post-treatment measurements (Abdullah et al., 2022). This experimental research model with control groups and experiments allows researchers to compare the learning outcomes of students who receive special treatment with those who do not, so that the influence of the CRT approach can be empirically known.

The subject of this study is a student of class X of SMA Negeri 65 Jakarta. Sample selection is carried out using the type probability sampling techniques random sampling, where each person in the population has an equal opportunity to be chosen, regardless of differences or strata within the population (Payadnya et al., 2018). The sample in this study consisted of 2 classes with a total of 64 students, which were divided equally into control and experimental classes.

The research procedure in this study is divided into 3 stages namely the preparation stage, the implementation stage, and the final stage. The preparation stage, in the implementation of the research, begins with field observations carried out at related school. This observation aims to identify real conditions that include the learning environment, interaction between teachers and students, and the condition of available facilities, such as textbooks, teaching aids, and technology used in teaching and learning activities. In addition, this observation process also includes monitoring the dynamics of the classroom, including students' behavior, their motivation to learn

mathematics, and the interaction process that occurs during learning activities. The results of this observation will be used as initial evaluation material before the researcher drafting a learning tool that suits the needs and characteristics of students. Creating the tools involves drafting teaching modules, assessment tools and learning activity steps that support the effective implementation of the CRT approach.

The implementation stage, after the learning tools have been prepared, then implementing the learning process in the classroom. Before starting the learning process, students are given a pretest to find out their level of numeracy ability before getting treatment. The learning process lasts for three hours of lessons, with each session lasting 45 minutes, where the material taught is related to statistics, especially the presentation of group data. The control class utilized traditional teaching methods for learning. Meanwhile, the experimental class utilized a method that integrates the CRT approach that emphasizes the cultural diversity of students, the relevance of the material to the local context, and the empowerment of students should be encouraged to think critically and engage actively in their learning experience. The activities carried out included group discussions, questions and answers, and the development of local culture-based projects in accordance with the previously determined numeracy ability indicators. This stage aims to stimulate students to be able to understand, apply, and interpret statistical data in a contextual and meaningful way. Once the learning in both classes came to an end, the researcher carried out a posttest on the control class and experiments. This posttest aims to measure the numeracy ability of students in both classes.

In the final stage, the researcher collected data and analyzed it using SPSS. The researcher conducted a normality test to ensure the distribution of the data, then a homogeneity test to check the similarity of variance. After that, the researcher carried out a t-test to compare the numeracy ability of students before and after the application of the CRT approach. In addition, a regression test was carried out to determine the influence of the learning approach on increasing numeracy scores based on pretest and posttest results. According to the findings of the analysis, the researcher can determine the impact of the method applied.

RESULT AND DISCUSSION

According to the research that has been conducted, the author will present the data on the results of the pretest and posttest in detail, as well as analyze the data. The findings of the study show that the application of the CRT approach has a significant and positive influence on improving students' numeracy ability. Furthermore, the discussion will be carried out by associating the results of the research with relevant theories to provide a deeper understanding of the influence of the applied approach.

Validity Test

Figure 1 is the result of the instrument validity test using SPSS. Based on the decision-making guidelines, namely *r* count > *r* table (Widodo et al., 2023). It is known that N = 32 and $\alpha = 0.05$, the table *r* value is 0.349. The calculation results show that *r* count > *r* table, therefore, all items of the instrument are declared valid. These outcomes align with the findings taken from a study by Oktania Dewantari et al, (2022) which indicated that all instruments were valid based on the same criteria.

		X1_a	X1_b	X1_c	X2_a	X2_b	X2_c	Y
X1_a	Pearson Correlation	1	.251	.466**	.763**	.276	-.189	.622**
	Sig. (2-tailed)		.166	.007	<.001	.126	.301	<.001
	N	32	32	32	32	32	32	32
X1_b	Pearson Correlation	.251	1	.216	.402*	.333	.351*	.595**
	Sig. (2-tailed)	.166		.235	.023	.062	.049	<.001
	N	32	32	32	32	32	32	32
X1_c	Pearson Correlation	.466**	.216	1	.436*	.653**	.255	.843**
	Sig. (2-tailed)	.007	.235		.013	<.001	.159	<.001
	N	32	32	32	32	32	32	32
X2_a	Pearson Correlation	.763**	.402*	.436*	1	.281	-.017	.673**
	Sig. (2-tailed)	<.001	.023	.013		.119	.929	<.001
	N	32	32	32	32	32	32	32
X2_b	Pearson Correlation	.276	.333	.653**	.281	1	.178	.759**
	Sig. (2-tailed)	.126	.062	<.001	.119		.331	<.001
	N	32	32	32	32	32	32	32
X2_c	Pearson Correlation	-.189	.351*	.255	-.017	.178	1	.381*
	Sig. (2-tailed)	.301	.049	.159	.929	.331		.032
	N	32	32	32	32	32	32	32
Y	Pearson Correlation	.622**	.595**	.843**	.673**	.759**	.381*	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	.032	
	N	32	32	32	32	32	32	32

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Figure 1. Result of Validity Test

Reliability Test

Figures 2 and 3 are the results of the reliability test of the instrument using SPSS. Based on the decision-making guidelines, namely *r* (Cronbach Alpha) > *r* table (Widodo et al., 2023). The results of the reliability test showed that the instrument used in this study had a value of Cronbach's Alpha reaches 0.728, this value is in the reliable category. Thus, it can be concluded that the instruments used in this study can be relied upon to collect valid and accurate data. These outcomes align with the findings taken from a study by Oktania Dewantari et al, (2022) that the instruments used in their research were declared reliable.

Cronbach's Alpha	N of Items
.728	6

Figure 2. Reliability Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X1_a	37.75	34.839	.466	.693
X1_b	38.28	34.983	.423	.702
X1_c	36.88	22.629	.657	.629
X2_a	37.75	35.161	.554	.680
X2_b	36.56	28.383	.579	.652
X2_c	37.47	39.547	.194	.752

Figure 3. Item-Total Statistics

Normality Test

Figure 4 shows the results of the normality test of the students' answers. Based on the decision-making guideline, which is a Sig. value of > 0.05, the distribution is normal (Sudirman et al., 2023). The results of the normality test using Shapiro-Wilk show that the data has a Sig. value of > 0.05,

therefore the data is normally distributed. These outcomes align with the findings taken from a study by Safirah et al, (2024), which indicated that the data was normally distributed based on the same criteria.

	Shapiro-Wilk		
	Statistic	df	Sig.
PreEksperimen	.971	32	.519
PosEksperimen	.962	32	.317
PreKontrol	.938	32	.067
PosKontrol	.941	32	.079

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Figure 4. Test of Normality

Homogeneity Test

Figure 5 shows the results of the homogeneity test of the students' answers. Based on the decision-making guidelines, if the Levene Statistic value is > 0.05, then it can be said that the data variation is homogeneous (Nuryadi et al., 2017). The results of the homogeneity of variance test show a significance value greater than 0.05, therefore, it can be inferred that the variance in data between the experimental and control groups is consistent. These outcomes align with the findings taken from a study by Safirah et al, (2024), which indicated that the data used in their study was homogeneous.

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	.017	1	62	.896
	Based on Median	.021	1	62	.885
	Based on Median and with adjusted df	.021	1	61.813	.885
	Based on trimmed mean	.025	1	62	.876

Figure 5. Test of Homogeneity of Variance

***t* Test**

Figure 6 is the result of the t-test of the students' answers. Based on the decision-making guidelines, namely H$t_{hit} > t_{tab} \rightarrow$ H0, rejected $t_{hit} < t_{tab} \rightarrow$ H1, accepted (Nuryadi et al., 2017). The findings from the independent *t*-test indicated a *t*-count value of 2.915 along with a p-value of 0.005. Since the p-value is less than the significance threshold of α = 0.05, we can conclude that a significant difference exists between the experimental group utilizing the CRT approach and the control group concerning the enhancement of students' numeracy ability. The relatively large *t*-count value shows that the treatment of students through the CRT approach has a real positive effect on their numerical abilities. Therefore, the theory suggests that there is a notable impact of the CRT approach on improving students' numeracy ability (H1) is acceptable, which also confirms the success of the application of this method in statistically improving student learning outcomes. These outcomes align with the findings taken from a study by Wardana et al, (2024), which indicated that there were differences in learning outcomes between the experimental class and the control class.

		Levene's Test for Equality of Variances		t-test for Equality of Means			
						Significance	
		F	Sig.	t	df	One-Sided p	Two-Sided p
Result	Equal variances assumed	.002	.968	2.915	62	.002	.005
	Equal variances not assumed			2.915	61.997	.002	.005

Figure 6. Independent Samples Test

Regression Test

Based on significance values on the output of Figure 8, the Sig. value for the variable pretest against posttest was < 0.001. This value is less than 0.05 (Sig. < 0.05), so it can be concluded that alternative hypothesis (H1) accepted. This means that there are significant influence between the values pretest against the value posttest. In other words, learners' pretest results affect their posttest results in measuring numeracy ability. Based on the constant value of 32,842 and the regression coefficients for the pretest by 1,300. That is, if the score pretest increase by one point then the score posttest is predicted to increase by 1,300 points. This shows that there is a positive relationship between the values of the pretest and posttest. The standard Beta coefficient is 0,425 indicates that the pretest has moderate influence against the posttest value. Thus it can be concluded that the score pretest make a significant contribution to the improvement of the score posttest of learners. In Figure 7, R Square indicates a value of 0,181. This shows the value of pretest contribute as much as 18,1% against the variation of the value of posttest Learners. While the rest, namely 81,9%, was explained by other factors not included in this regression model. These outcomes align with the findings taken from a study by Wardana et al, (2024) that learning with the CRT approach has a positive influence on the activeness and learning outcomes of students.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.425[a]	.181	.168	18.319

a. Predictors: (Constant), PreTest
b. Dependent Variable: PostTest

Figure 7. Model Summary

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	32.842	4.332		7.581	<.001
	PreTest	1.300	.351	.425	3.702	<.001

a. Dependent Variable: PostTest

Figure 8. Regression Coefficient Test

In line with these results, there is a significant influence of the application of the CRT approach on students' numeracy ability, which shows that this method is successful in improving mathematics learning outcomes, especially in statistical materials.

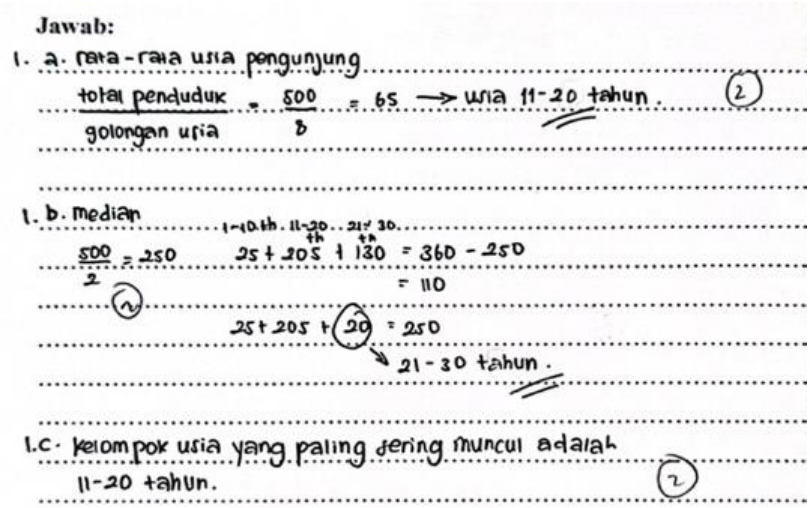


Figure 9. Results of Pretest Answer Number 1

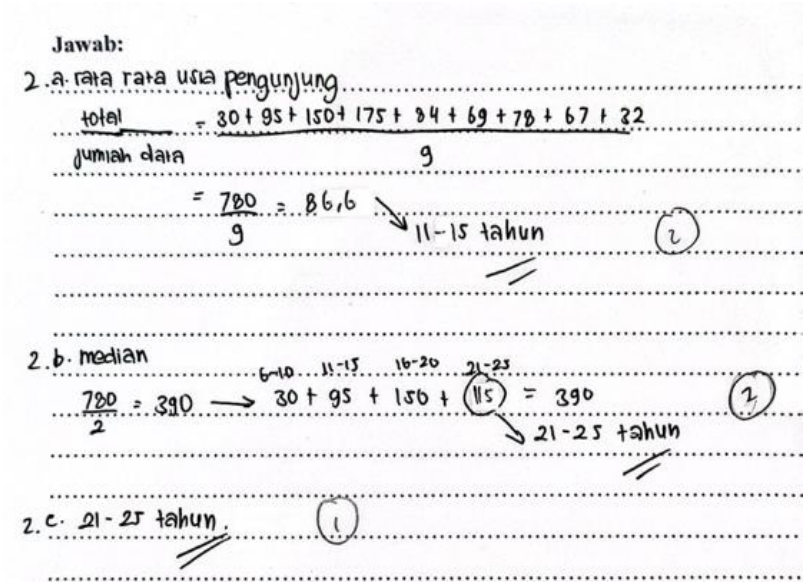
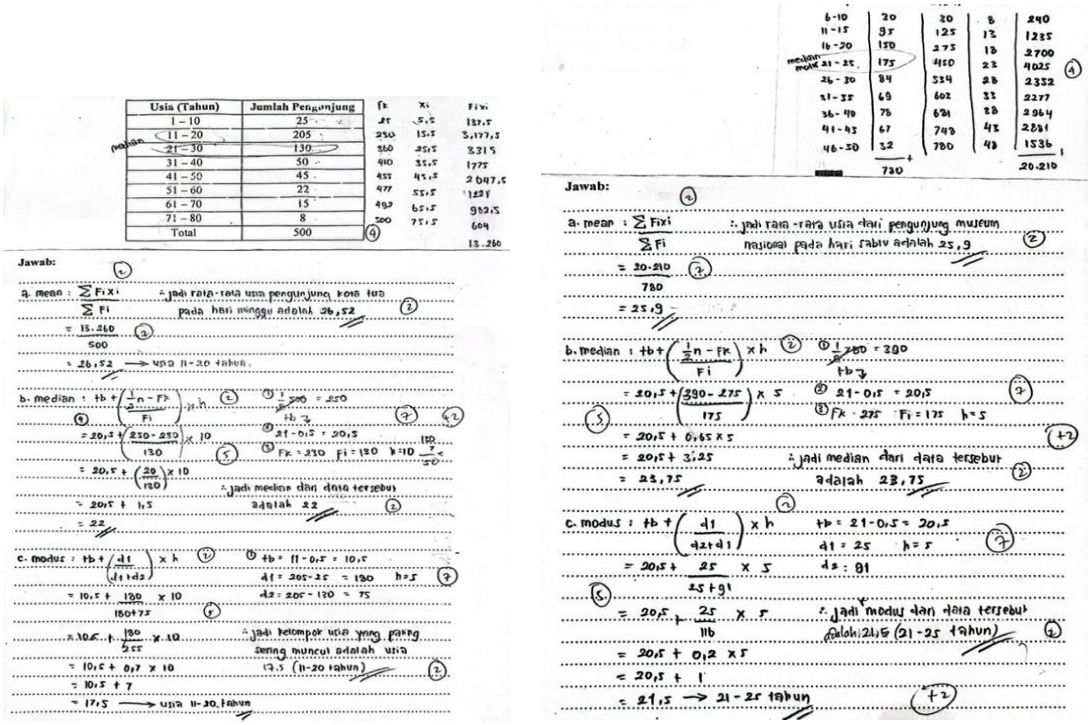


Figure 10. Results of Pretest Answer Number 2

Based on the pretest results shown in Figures 9 and 10, students in the experimental class still had difficulty answering questions related to group data. Most students are not able to relate the information in the problem to statistical concepts correctly, are not used to compiling data in the form of frequency distribution tables, do not write down the solution steps systematically, and often skip making the conclusion from the calculation results. This reflects that students' numeracy ability in the early stages are still low and have not reached the expected competencies.



(i) (ii)

Figure 11. Results of Post-test (i) Number 1, (ii) Number 2

Figures 11, which are the results of the posttest after the implementation of the CRT approach, it can be concluded that students have been able to write and answer questions according to the numeracy ability indicators quite well. Students understand basic statistical concepts such as averages, medians, and modes, and can apply relevant formulas to solve the given problems.

This study aligns with the theory that learning that integrates students' cultural knowledge can create an inclusive and relevant learning atmosphere (Abdalla et al., 2024; Bassey, 2016). By respecting the cultural identity of learners and relating the subject matter to their life experiences, this approach can increase motivation and active participation in the learning process. In addition, this study supports the results of previous studies that showed that the PBL model combined with the CRT approach can improve mathematical communication ability and critical thinking (Arvianto et al., 2024; Safirah et al., 2024).

CONCLUSION

Considering the findings of this research, it can be inferred that the implementation of the CRT approach in the mathematics learning process, especially in class X statistics, has a significant influence on improving students' numeracy ability. Through the initial stages of observation and preparation of learning tools relevant to the local culture, the learning process is carried out systematically and context-based. Data analysis using a statistical test *t* showed that students who participated in learning with the CRT approach experienced significant improvement in numeracy ability than the control group. Thus, this study makes an important contribution to the development of innovative and culture-based learning models and shows that the CRT approach is able to significantly improve mathematics learning outcomes. This success also opens up opportunities for the development of learning methods that pay more attention to the cultural diversity of students, so that mathematics leaning becomes more effective, fun, and meaningful for students.

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