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IMPROVING UNDERSTANDING OF MATH STORY PROBLEMS THROUGH CULTURALLY RESPONSIVE TEACHING APPROACH IMPLEMENTATION

Anisa Agustiana[1*], Encep Supriatna[2], Komariah Sani [3]
[1]Pendidikan Profesi Guru, Universitas Terbuka, Serang, Indonesia
email: nisaagus97@gmail.com
[2]Pendidikan Guru Sekolah Dasar, Universitas Pendidikan Indonesia, Serang, Indonesia
email: encepsupriatna@upi.edu
[3]Sekolah Dasar Negeri Ciruas I, Serang, Indonesia
email: komariahsani@gmail.com

Abstract: This study aims to improve the understanding of mathematics story problems among fourth-grade students at SDN Ciruas I through the implementation of the Culturally Responsive Teaching (CRT) approach. The research background stems from students' low ability to solve story problems, which are often non-contextual and lack relevance to their cultural backgrounds. CRT aligns learning with students' culture, life experiences, and local context to create a more meaningful and inclusive learning process. This research employed a qualitative Classroom Action Research (CAR) method conducted in two cycles. The subjects were 34 fourth-grade students of SDN Ciruas I. Data collection techniques included observation, interviews, written tests, and documentation. Data were analyzed both qualitatively and quantitatively to evaluate changes in students' understanding before and after the intervention. The results showed that the CRT approach enhanced student engagement during learning and improved their ability to understand and solve mathematics story problems. This approach proved effective in contextual mathematics learning, especially in culturally diverse classrooms. The study recommends integrating CRT into the curriculum and teacher training programs to promote learning that supports the diverse needs of students.

Keywords: classroom action research; culturally responsive teaching; elementary school; mathematics; story problems.

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INTRODUCTION

The ability to solve mathematical problems that are arranged in the form of stories is a basic and fundamental skill in solving mathematical problems. Story problems usually appear as verbal descriptions of problem situations in which one or more questions are asked whose explanations can be obtained by applying mathematical operations to the numerical information available in the problem explanation (Verschaffel et al., 2020). Many elementary school students, especially in grade IV, have difficulty in solving math story problems compared to direct calculation problems. This is because

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students do not fully understand the concepts being studied, so they often make mistakes in using formulas (Rizkyta & Astriani, 2024).

Based on the assessment results, it was found that the low mathematics learning outcomes of students, especially on story problems, were due to the fact that they did not fully understand the mathematical concepts. According to (Dwidarti et al., 2021) story-based problems are considered to have a higher level of difficulty compared to math problems presented in the form of direct mathematical calculation models. A fourth-grade teacher explained that her instructions for teaching students to solve story problems were to identify keywords and then solve the problem (Pearce et al ., 2011).

Story problems taught by teachers in class often do not pay attention to the cultural background or daily life of students. As a result, the material is less relevant and is considered difficult to understand. In addition, facts on the ground show that the approach used by teachers is still conventional and does not pay attention to the diversity of students' cultural backgrounds. Of the 34 students who were given a story problem test, only 20.6% of students were able to answer correctly, while the other 79.4% made mistakes in understanding the contents of the questions, applying formulas, or choosing the right mathematical operations. Each student comes from a different cultural background, so it needs to be accommodated in learning so that students feel connected to the material being taught.

According to (Yani & Susanti, 2023) teachers still use a learning approach that assumes that all students have uniform needs and characteristics, without considering individual differences between them. Through the Culturally Responsive Teaching approach, it can be a solution to the above problems. CRT is a learning approach that links culture, experience, student background with materials, assessments, and learning media. The results of previous studies show that prospective teachers continue to struggle with their ideas about culture, race, and ethnicity and are highly committed to their ability to teach in a culturally responsive manner or CRT (Atwater et al., 2010).

This research was conducted at SDN Ciruas I because it has diverse cultural and socio-economic backgrounds of students. This certainly affects the way they understand the subject matter, including in solving mathematical story problems. There is a close relationship between reading comprehension skills and mathematical story problem solving skills. Students need to have the ability to understand reading, one of which is by reading story problems repeatedly to find the main problem in the problem. Through a good understanding of the contents of the reading, students will find it easier to determine the right steps to solve the story problems given by the teacher (Fahrozy, 2023).

The Culturally Responsive Teaching (CRT) approach is considered to be a solution in the form of significant potential in enriching the learning process and helping students develop a deeper understanding of mathematical concepts related to culture. According to (Fitriah et al., 2024) this approach invites students to learn in a context that is relevant to their cultural background, so that learning becomes more meaningful, inclusive, and able to foster an attitude of mutual respect for differences. However, until now there has been little research that examines the implementation of CRT specifically in mathematics learning, especially in solving story problems at the elementary school level. SDN Ciruas I has implemented the independent curriculum since 3 years ago until now. The Independent Curriculum is designed based on the needs, abilities, and character of students. The government gives teachers and schools the freedom to develop a

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curriculum according to the background of students through the Culturally Responsive Teaching approach (Sari et al., 2024).

Based on the conditions at SDN Ciruas I, especially grade IV, the CRT approach is important to be studied further. Linking mathematical story problems with local culture can be started by designing learning and assessments that are in accordance with the principles of the CRT approach. Therefore, the study entitled "Improving Understanding of Mathematical Story Problems Through the Application of a Culturally Responsive Teaching Approach" aims to analyze the effect of the CRT approach in improving students' understanding of mathematical story problems. This study is important because there are still limited studies that specifically link the culture-based learning approach to improving elementary school students' mathematical literacy skills, especially in local contexts that have cultural diversity such as at SDN Ciruas I. In addition, not many teachers have implemented contextual mathematics learning by considering the cultural background of students. Thus, this study is expected to provide theoretical and practical contributions in the development of learning strategies that are more relevant, meaningful, and in favor of the real needs of students in culturally heterogeneous classes.

METHOD

This research uses a qualitative approach with the Classroom Action Research (CAR) method which is carried out to study an object through the application of scientific methods, with the aim of obtaining valid data or information to improve quality and provide contributions to areas of interest and considered important by researchers (Purohman, 2011). The subjects of this study were 34 grade IV A students at SDN Ciruas I, Banten, who were on average 9 – 10 years old. This location was chosen because it was relevant to the problem raised, namely the low level of students' understanding of story problems that were less contextual to their daily experiences. This study was conducted in several stages, namely planning, implementing actions, observing, and reflecting, with the aim of implementing local culture-based learning to increase student involvement and understanding.

Data collection techniques in this study include observation, interviews, comprehension tests, and documentation. Observations were conducted to record student participation and interaction during CRT-based learning, while interviews were conducted with teachers and students to explore their experiences related to the implementation of this method. Comprehension tests were given in two cycles to measure the improvement of students' abilities in solving mathematical story problems, while documentation in the form of field notes, photos of activities, and student work results were used to support the research findings.

This research was conducted in two cycles, namely cycle 1 and cycle 2. This research was conducted by following several systematic stages to implement the Culturally Responsive Teaching (CRT) approach in learning mathematical story problems. The stages of this research can be seen in the table below.

Table 1. Stages of Classroom Action Research

Stage	Description
Planning	The researcher planned everything that became a reference in this research. Starting from problem identification, device development and learning assessment using the CRT approach.

Implementation	At this stage, the researcher implemented the CRT approach in the classroom.
Observation	Researchers collected data through interviews with students and teachers, story comprehension tests, and observation sheets.
Reflection	Identification of successes and obstacles in implementing the CRT approach in the classroom, as well as improvements to learning strategies based on reflection results to improve student understanding in the next cycle.

Data analysis was conducted quantitatively and qualitatively to provide a comprehensive picture of the effectiveness of CRT in mathematics learning. Test result data were analyzed descriptively to see the differences between the first and second cycles, while observation and interview data were analyzed using triangulation to identify patterns of student engagement and challenges faced. The results of this analysis are expected to be the basis for reflecting on and refining mathematics learning strategies that are more contextual, meaningful, and in accordance with the local culture of students at SDN Ciruas I.

The average student learning outcomes were calculated by adding up the total scores obtained by students and dividing them by the number of students who took the written test, both in cycle 1 and cycle 2. The formula used in calculating the average is as follows.

$$\bar{x} = \frac{\sum x}{N}$$

Description:
$\bar{x}$ = Mean
$\sum x$ = Total value
N = Number of students

RESULT AND DISCUSSION

Based on the results obtained, the level of success of the implementation of the CRT approach in mathematics learning can be measured from the number of students who have achieved a very good or good predicate in understanding mathematical story problems integrated with culture or local wisdom in the Banten area. Before starting the learning intervention, initial observations were carried out which aimed to identify and carry out diagnostic assessments on fourth grade students at SDN Ciruas I in mathematics subjects. Diagnostic assessments can be helpful, because they provide information about the actual level of development of each student (Csapó & Molnár, 2019). The results obtained are used as a reference point in evaluating the effectiveness of previously implemented teaching and learning activities.

The results of the analysis show that there are 34 students consisting of 7 students who get a score above 75 indicating low overall learning completeness. The following is a table and diagram of the percentage of pre-cycle student learning outcomes in grade IV.

Table 2. Pre-Cycle Learning Outcomes

Description	Result
Highest score	90
Lowest score	50
Class average	68
Number of students completed	7
Number of students not completed	27

Percentage of completion	20,6%

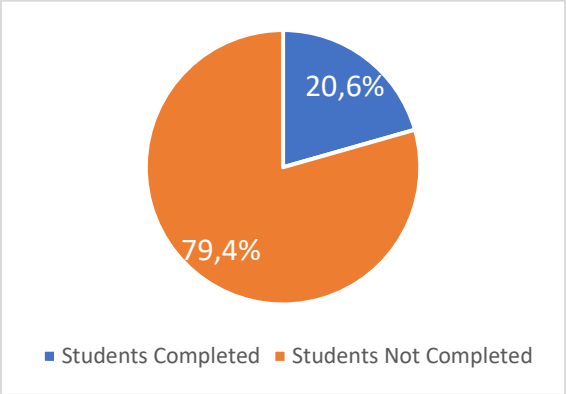

Figure 1. Percentage of Completion of Pre-Cycle Learning Outcomes

The results of the data analysis in table 2, figure 1 show that the percentage of fourth grade students who have not achieved the Learning Objective Achievement Criteria (KKTP) is very high, reaching 79.4% or 25 students with a class average of 68 which is classified as low and has not achieved KKTP. Based on these findings, it shows that there are serious problems related to the understanding of mathematical concepts of fourth grade students at SD Negeri Ciruas I. According to Ambarsari et al (2024) choosing the right approach in implementing change interventions is a crucial factor to ensure the effectiveness of the intervention and its suitability to the context at hand. Therefore, an appropriate solution to this problem is needed in the form of an appropriate and effective approach to overcome challenges in understanding students' mathematical story problems. This study was conducted with the aim of improving understanding of mathematical story problems through the application of the Culturally Responsive Teaching approach.

Cycle 1

Starting from the planning stage of cycle 1, the researcher developed a learning device consisting of a teaching module, teaching materials, learning media, and assessment devices. This learning device was designed to support mathematics learning with the material of the circumference and area of flat shapes with a problem-based learning model and integrating the CRT approach. This CRT approach was chosen because it is very appropriate to improve students' understanding of mathematical story problems with their daily lives. In addition, the CRT approach also creates a positive relationship between students and teachers as a basis for learning (Marczewska et al., 2023).

The implementation begins with preliminary activities consisting of greetings, prayers, checking attendance, apperception, motivation, and delivery of learning objectives. Then enter the core activity section using the syntax of the Problem Based Learning model in the orientation phase where students are presented with trigger questions and teaching materials integrated with local culture. The next phase, namely the teacher organizes students into several heterogeneous groups and aims to be able to learn from each other in answering the student worksheets that have been distributed. The

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form of implementation of the CRT approach is that the teacher provides problems or questions presented in the student worksheets in cycle 1 associated with the context of the local culture typical of Banten. As a figure who has a great influence in the classroom, the teacher plays an important role in shaping participants' understanding of teaching methods that are appropriate for a particular context, selecting the right curriculum materials, and determining who needs to get the opportunity to study science in a quality manner (Atwater et al., 2010). These mathematical story problems are integrated with the shape of the traditional house of the Baduy tribe (Sulah Nyanda) and geometric measurement problems in everyday life, such as the shape of the school field, the area of rice fields, the circumference of woven mats, and so on.

The third phase is the presentation of each group's answers and the last is the evaluation phase. In the closing activity, students are given evaluation questions containing questions about the material that has been discussed. This aims to measure the achievement of learning objectives at the end of cycle 1. The following is a table and picture of student learning outcomes in cycle 1.

Table 3. Learning Outcomes Cycle 1

Description	Result
Highest score	100
Lowest score	60
Class average	80
Number of students completed	22
Number of students not completed	12
Percentage of completion	65%

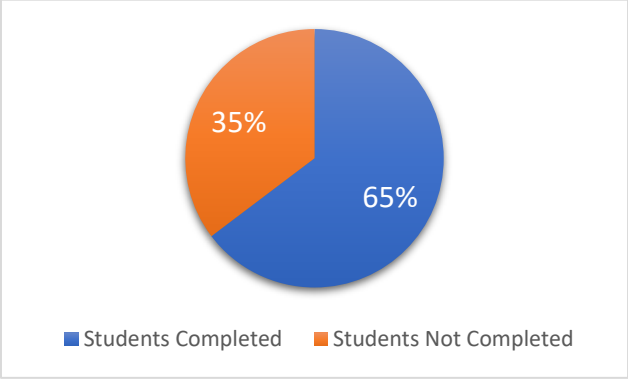

Figure 2. Percentage of Learning Outcome Completion in Cycle 1

Analysis in table 3, figure 2 shows that there was an increase in student learning outcomes in Cycle 1 compared to the pre-cycle stage. The highest score achieved increased from 90 to 100, while the lowest score increased from 50 in the pre-cycle to 60 in Cycle 1. The average class score also increased to 80, indicating an improvement in general learning achievement. Of the 34 students, 22 students (65%) have achieved learning completion with a score above 75. Meanwhile, there are still 12 students (35%) who have not completed it. This 65% completion percentage shows positive developments compared to the initial conditions, but the minimum completion target (usually 85% or more) has not been fully achieved. This means that follow-up is still needed in the form of improving learning strategies so that the 35% of students who have not completed it can be helped to achieve the expected standard in the next cycle.

(Enjelina et al., 2024).

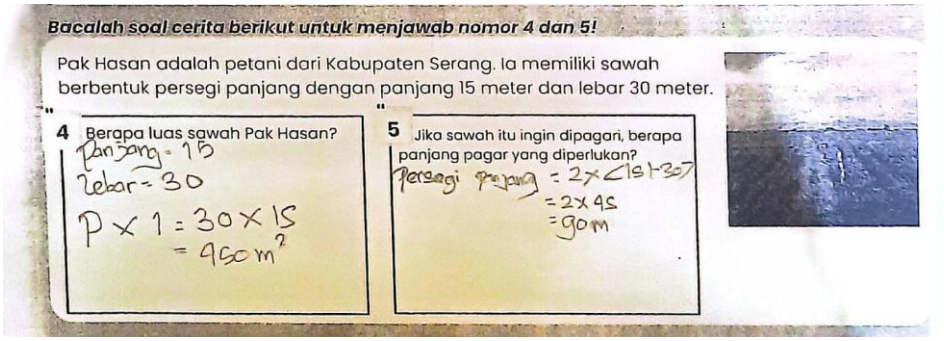

Figure 3. Answers of Students with the Highest Scores in Cycle 1

Some things that are reflective notes for teachers as a means to make improvements are the ability to understand students' mathematical story problems is fairly good with a class average of 80, while the indicator of success is if the class average is at a very good predicate or with a value range of 90 - 100. Students are not yet accustomed to working on problem-solving story problems that are linked to local culture, so that many students still answer only the final result without a calculation method. Teachers can evaluate the success of the solutions applied, assess their effectiveness, and determine further steps to improve teaching practices through a classroom action research approach and learning based on the CAR cycle. (Meesuk et al., 2020).

Cycle 2

Based on the findings in cycle 1, the research continued to cycle 2 by adjusting the learning plan. The teaching module in cycle 2 refers to the results of reflection on cycle 1, while still integrating the CRT approach and PBL model. Many improvements were made in the implementation of cycle 2. Teaching materials were more designed with local cultural integration to be able to increase the close relationship between the subject matter and students. Then the evaluation questions were also arranged with simpler sentences equipped with pictures that match the math story questions. According to Walkington et al (2025) various factors outside the text play a role in influencing student performance in solving math story problems, such as the background of students' mathematical knowledge, the characteristics of the problems faced, school conditions, and the form of instruction or learning received. Do not forget to include a work guide so that students work accompanied by a complete calculation method. For students who have not completed cycle 1, special guidance is provided by the teacher during the learning activities.

To measure cycle 2 research, evaluation questions were given again in the closing activity. The following are the evaluation results contained in the form of tables and images below..

Table 4. Learning Outcomes Cycle 2

Description	Result
Highest score	100
Lowest score	73
Class average	87
Number of students completed	30

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Number of students not completed	4
Percentage of completion	88%

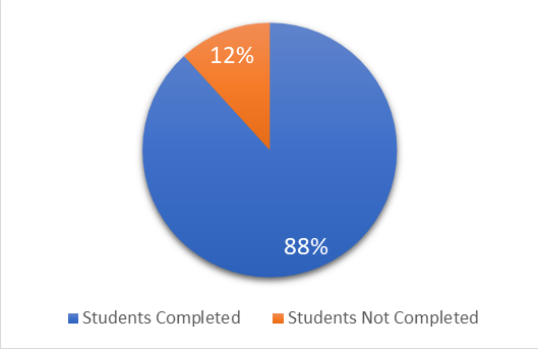

Figure 4. Percentage of Learning Outcome Completion in Cycle 2

Based on the findings in cycle 2, it shows that the implementation of the Culture Responsive Teaching approach has proven effective in improving understanding of fourth grade students' mathematical story problems, as seen in table 4, figure 4. Data analysis reveals that students' learning performance is generally classified as good, with a completion rate of 88% and an average score of 87. This achievement confirms that the implemented learning strategy has made a positive contribution to improving students' learning outcomes, especially in the material on the circumference and area of flat shapes.

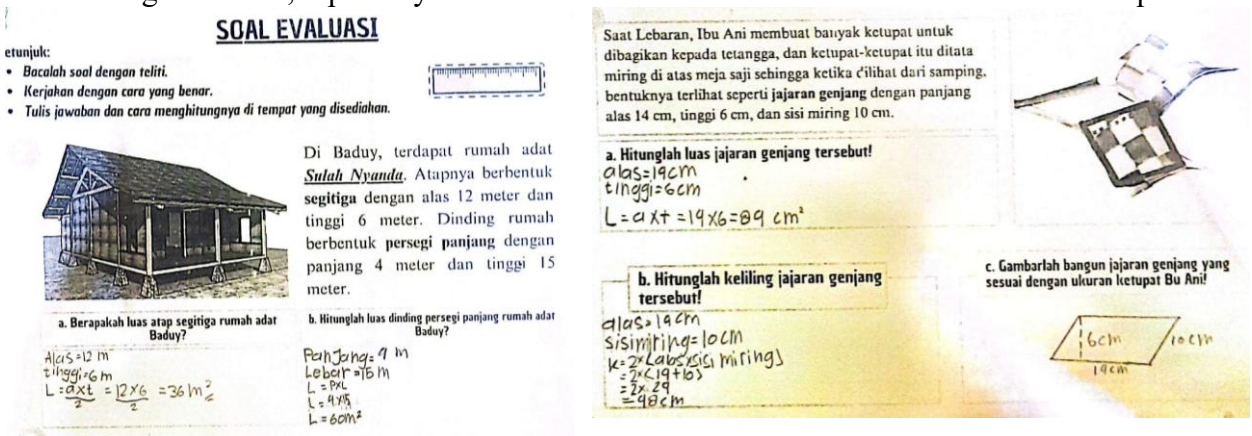

Figure 5. Answers of Students with the Highest Scores in Cycle 2

In addition, observations made during the learning process showed an increase in active student involvement in cycle II. Student participation in group discussions and in solving story problems related to local culture played a role in encouraging better learning outcomes, as reflected in the percentage of completion which increased to 88%. This is also in line with previous research conducted by (Alsina et al, 2025) which examines a variety of mathematical materials, which show various opportunities in classroom mathematics learning to approach the characteristics of responsive and attentive teaching by teachers. The increase in the number of students who achieved the completion standard was also accompanied by an increase in the average class score at each stage of implementation. The following graph shows a positive trend in the development of the average student score.

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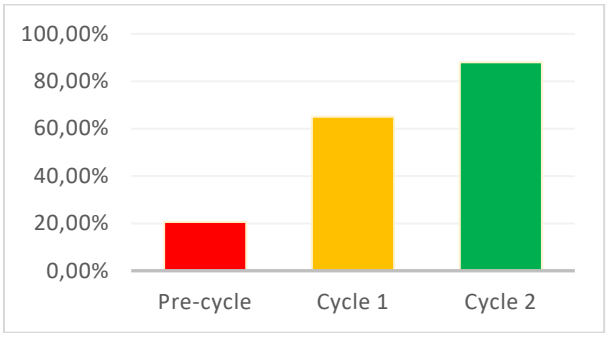

Figure 6. Increase in Percentage of Learning Outcome Completion

The improvement of student learning outcomes can be seen from the increase in the average class value recorded in each cycle in this research process. Each stage of learning implementation shows positive developments in student learning outcomes, which indicates that the strategies implemented are running effectively. Success in managing this learning ultimately contributes directly to achieving the goals that have been designed from the start, namely improving student learning outcomes (Wahono et al, 2020). To provide a clearer picture, the following is an illustration showing the trend of increasing average scores for all students at each stage of the study.

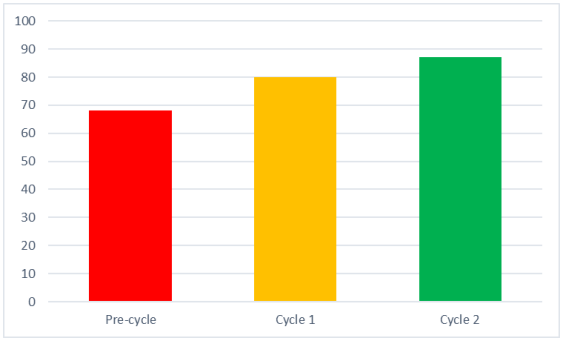

Figure 7. Average Increase in Learning Outcomes

This finding confirms that the implementation of the Culture Responsive Teaching approach in mathematics learning at SDN Ciruas 1 is effective in improving learning outcomes. A significant increase in both the number of students who completed and the average class score, especially on the topic of circumference and area of flat shapes, confirms the importance of linking mathematics learning to cultural contexts that are relevant to students. This shows that the influence of the implementation of the Culture Responsive Teaching (CRT) approach, especially in the presentation of teaching materials, learning media, learning activities, and assessments, has a significant impact on student understanding. In addition, the CRT approach can also be applied in other subjects, such as Natural and Social Sciences, Pancasila Education, Indonesian Language, Arts and Culture and Crafts, and so on. Based on previous research, it shows that the Culturally Responsive Teaching (CRT) approach in Indonesian language learning has been shown to have a significant impact on improving student learning outcomes. In addition, this approach is also able to increase student enthusiasm and involvement in the learning process (Fatonah et al., 2024).

CONCLUSION

Based on the results of the discussion, it shows that the implementation of the Culturally Responsive Teaching (CRT) approach significantly improves the understanding of fourth grade students of SDN Ciruas I on mathematical story problems. Before the intervention, only 20.6% of students achieved learning completion with a class average of 68, indicating a low understanding of mathematical concepts taught conventionally and less contextual with students' daily experiences and lives. After the CRT approach was implemented, which linked story problems to local Banten culture, student learning outcomes increased in each cycle. In cycle 1, learning completion increased to 65% with a class average of 80, although there were still 35% of students who had not reached the minimum standard. Through improvements in learning in cycle 2, such as simplifying questions, stronger cultural integration, and special guidance, the percentage of completion increased to 88% with a class average of 87, exceeding the expected minimum target.

Thus, the CRT approach has proven effective in improving students' mathematical story problem comprehension skills, because it is able to link the subject matter to their daily experiences and culture. In addition, this strategy is also able to create a more inclusive, relevant, and meaningful learning atmosphere, and helps reduce the gap in understanding between students with diverse cultural backgrounds. This finding also emphasizes the importance of implementing culturally responsive learning in a heterogeneous classroom context such as at SDN Ciruas I. This study only consisted of two cycles, if similar research is conducted in the future, it is hoped that it can be carried out in more than two cycles, so that the results or feedback obtained are more comprehensive.

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