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Efforts To Improve Understanding Of The Concept Of Composite Reduction Using Digital Scratch Media With The CRT Approach

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Abstract

This study aims to improve the understanding of the concept of compound subtraction through Scratch media with the Culturally Responsive Teaching (CRT) approach in grade II students of SD Negeri 066055 Medan Denai. This study is a Classroom Action Research (CAR) with the Kemmis, McTaggart, and Nixon model which is implemented in two cycles. Each cycle consists of planning, action, observation, and reflection stages. The research subjects were 15 students, consisting of 8 boys and 7 girls. Data were collected through pretest and posttest tests to measure the ability to understand mathematical concepts, as well as documentation to support the learning process. The results of the study showed that in cycle I, students who completed the learning only reached 40% or 6 out of 15 students. After learning improvements were made in cycle II, there was a significant increase, namely as many as 13 out of 15 students (86.67%) reached the specified Minimum Completion Criteria (KKM), which is ≥70. These results indicate that the use of Scratch media combined with the CRT approach is able to improve students' understanding of the concept of compound subtraction. This approach allows students to learn in a way that is more contextual, engaging, and appropriate to their cultural background.

Keywords : Conceptual Understanding, Multilevel Subtraction, Scratch, Culturally Responsive Teaching (CRT), Grade II Elementary School

INTRODUCTION

Introducing mathematics to elementary school children is crucial because they encounter mathematical concepts in everyday life without realizing it. For example, when children count their pocket money, divide food, or decide when to play. However, teaching them to understand formal mathematical models and symbols is no easy task. The transition from concrete experiences to symbolic representations presents a unique challenge for teachers, particularly in materials that require in-depth conceptual understanding, such as multiplication (Rosydiana et al., 2023).

In lower grades, such as second grade, conceptual understanding is crucial because students are transitioning from concrete thinking to operational thinking. In this context, materials like subtraction require more than simply memorizing algorithmic steps. Students need to understand the meaning of "borrowing" or "subtracting tens and ones" logically and contextually. However, many students struggle with transitions from concrete activities, such as stacking 23 cookies and subtracting 15, to symbolic forms like 23-15, or borrowing from tens to ones.

Subtraction is one of the topics studied in grade II of elementary school, where in the Mathematics Learning Outcomes Phase, namely the reference for intracurricular learning, it is written that students can add and subtract whole numbers up to 20. Based on the results of observations in grade II at SD Negeri 066055 Medan Denai, students apparently still do not understand the concept of nested subtraction, especially if the subtraction process requires a borrowing or lending process (Hutapea, 2020).

The same thing also happened elsewhere, such as in a study conducted by Pertiwi, Rofian, and Cahyadi (Berlian et al., 2024), where second-grade students at Sumbermulyo Public Elementary School experienced difficulty understanding the concept of subtraction, particularly in determining the place value of numbers. This difficulty was caused by a lack of understanding of basic concepts and an inability to relate the material to students' everyday experiences.

This difficulty indicates that students do not fully grasp the concept of subtraction. According to Darmin & Kamawati (Pane, 2024), conceptual understanding in mathematics learning plays a crucial role as a basis for thinking in solving various mathematical problems and real-life situations. A well-understood concept provides the foundation for logical thinking to address subsequent problems. In addition to making mathematical material feel more tangible and easier to reflect on, conceptual understanding also helps students develop reasoning skills. Therefore, teachers need to provide learning experiences that enable students to construct their own meaning for each concept, from real-world contexts, visual representations, to mathematical symbols (Asnawati et al., 2019).

One solution to help bridge this gap is through the use of media that visualizes the subtraction process in a concrete and engaging way. This visualization makes it easier for students to build mental images (the ability to imagine something in their minds) of the mathematical operations they are learning, and strengthens their understanding of the meaning of mathematical symbols. One solution that can be implemented is the use of visual coding websites such as Scratch. Through this website, teachers can create learning media tailored to students' needs. Research by Khalil and Wardana (2022) shows that the use of Scratch media in mathematics learning can improve elementary school students' higher-order thinking skills (Anam, 2025).

Furthermore, the process of understanding concepts will be more meaningful when linked to the cultural context and students' daily experiences, as recommended in the Culturally Responsive Teaching (CRT) approach. Linking mathematical concepts to things familiar and close to students' daily lives, such as local snacks, family customs, or the surrounding environment is expected to help students feel more connected to the material, and ultimately improve their understanding. Furthermore, a culturally responsive learning

approach can increase student engagement and motivation. This approach views students' cultural backgrounds as strengths that can increase engagement and motivation (Ali et al., 2024).

Based on this background, researchers conducted classroom action research (CAR) to improve understanding of the concept of multilevel subtraction using Scratch media and the CRT approach, so that students can understand the concept in depth and meaningfully (Komala et al., 2024)

RESEARCH METHODS

The type of research used in this study is Classroom Action Research (CAR). According to Suprayitno (Marifatulloh et al., 2024), Classroom Action Research is research conducted by teachers in their classrooms through self-reflection activities to improve their performance as teachers so that they can improve student learning outcomes compared to before. This study uses an experimental type of Classroom Action Research (CAR), which is a form of research conducted with the aim of optimally applying various techniques or strategies to increase effectiveness and efficiency in the learning process. This classroom action research refers to the model developed by Kemmis, McTaggart, and Nixon, which consists of four main stages, namely: planning (*Planning*), implementation of actions (*Action*), observation (*Observation*), and reflection *(Reflection*). These four stages form a continuous cycle in an effort to improve the learning process (Agung Saputro et al., 2018) . The following is the flow of classroom action research (Khalil & Wardana, 2022) :

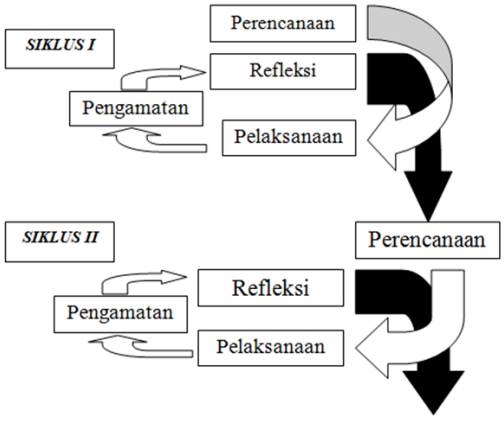

Figure 1. Classroom Action Research Flow

This research was conducted at Medan Denai State Elementary School 066055, located on Jl. Kasuari 2, Kelurahan 2, Tegal Sari Mandala II Village, Medan Denai District, Medan City. The research was conducted from April 14, 2025, to May 9, 2025.

The subjects of this study were 15 second-grade students at Medan Denai State Elementary School 066055, consisting of 8 boys and 7 girls. The object of this study was the

application of Scratch media as an effort to improve conceptual understanding of the material on compound subtraction in the class. (Prawiyogi et al., 2021) .

1) Planning

At this stage, the researcher and class teacher jointly develop an action plan to be implemented in the classroom. Some of the main activities carried out include:

1) Identifying learning problems, namely low understanding of the concept of compound subtraction.
2) Develop a Learning Implementation Plan (RPP) that includes learning activities using Scratch media with a *Culturally Responsive Teaching* (CRT) approach.
3) Designing interactive Scratch media that suits student characteristics and local culture.
4) Compile research instruments such as observation sheets, evaluation questions, and assessment rubrics.
5) Prepare learning logistics such as technological devices, visual media, and other supporting facilities.

2) Implementation of Action (*Action*)

This stage is the implementation of the plan that has been prepared. The teacher conducts Mathematics lessons with the topic of nested subtraction using Scratch media in grade II. Activities are carried out in accordance with the syntax of problem-based learning and the CRT approach, with attention to active student involvement and the integration of local cultural contexts into learning activities. Learning takes place in two cycles, each consisting of one to two meetings. (Komala et al., 2024).

3) Observation

During the action process, researchers and collaborators made observations of:

1) Student involvement in participating in learning
2) How students respond to Scratch media and the questions presented
3) Student performance in solving multiplication problems
4) General classroom situation, including student and teacher interactions
5) This observation was carried out using prepared instruments, such as observation sheets, field notes, and photo and video documentation.

4) Reflection

After the learning and observations were completed, the researcher and teacher reflected on the results obtained during the cycle. The purpose of this reflection was to:

1) Assess the success of the actions that have been taken
2) Identifying deficiencies or obstacles during the learning process
3) Develop a plan for improvement or adjustment for the next cycle

If the learning objectives have not been achieved optimally in the first cycle, improvements are made and continued to the second cycle.

The instruments used in this study were designed to measure students' understanding of the concept of compound subtraction and document the implementation process. The instruments used were *pretest* and *posttest* questions . to measure the improvement in students' understanding of the concept of multilevel subtraction before and after the action was carried out and documentation in the form of photos, videos, and field notes was used

to record the learning process, student activities during the use of Scratch media, and teacher and student interactions. This documentation was also used to supplement observation data during the action process (Rosydiana et al., 2023) .

Data collection in this study was carried out using the following techniques:

1) Written Test . A *pretest* was conducted before the learning activity began to determine students' initial understanding of compound subtraction. After the activity was carried out, *a posttest* was administered to determine the extent to which students' understanding had improved after the Scratch learning media was implemented.
2) Documentation . Documentation techniques are used to collect visual and descriptive data during learning activities. This includes recordings of the teaching and learning process, student expressions and participation, and student work results as evidence supporting the development of conceptual understanding.

The data analysis technique in this study aims to determine the extent to which the ability to understand the concept of layered subtraction has improved after implementing learning using Scratch media. The data analyzed came from test results (*pretest* and *posttest*) as well as documentation during the learning process. (Sari & Manurung, 2021) .

The success criteria in this classroom action research were determined based on students' learning completion in understanding the concept of multilevel subtraction. Learning was considered successful if ≥ 80% of the students achieved a score of ≥ 70, in accordance with the Minimum Completion Criteria (KKM) for Mathematics as set by SD Negeri 066055 Medan Denai. Furthermore, success was also seen from the increase in the average score between *the pretest* and *posttest results* in each action cycle. This reflects an increase in conceptual understanding after the implementation of Scratch-based learning media. (Reyna et al., 2018)

RESULTS AND DISCUSSION

Description of Research Results

Cycle I

This classroom action research was conducted in two cycles. Cycle I was conducted to test the initial effectiveness of using Scratch media in improving the understanding of the concept of layered subtraction in grade II students of SD Negeri 066055 Medan Denai. Each cycle was implemented through four stages, namely: planning, action implementation, observation, and reflection (The SMERU Research Institute, GIZ, and Blavatnik School of Government, 2023) .

a) Planning

At this stage, the researcher and the class teacher prepared learning materials which included a Learning Implementation Plan (RPP), student activity sheets, *pretest* and *posttest questions* , and Scratch-based learning media. (Shevroja et al., 2021) . The designed material focuses on subtraction without first reviewing the concept of place value (tens and ones). Data collection instruments such as observation sheets and documentation were also prepared. (Wijaya et al., 2020) .

b) Implementation of Action (*Action*)

Before implementing the action, the teacher first conducted *a pretest* . The action was carried out in accordance with the prepared lesson plan. The teacher opened the lesson by linking the material to a traditional food context familiar to the students. Next, students were invited to use Scratch to solve multilevel subtraction problems. The tool featured visual animations and interactive problems that allowed students to slide images to demonstrate the subtraction process. Afterward, students completed practice problems and were given *a posttest* as a form of learning evaluation. The results of the research data in cycle I are as follows:

Table 1. Cycle I *Pretest Scores*

No.	Student Name	Mark	Completeness	
			T	TT
1.	Adira	66.67		✓
2.	Aira N	58.33		✓
3.	Aira S	100	✓	
4.	Alif	58.33		✓
5.	Alisha	50		✓
6.	Azka	58.33		✓
7.	Phase	58.33		✓
8.	Habibie	25		✓
9.	Hafiz	58.33		✓
10	Jhafira	75	✓	
11	Kenon	41.67		✓
12	Meisya	75	✓	
13	Muh. Umam	16.67		✓
14	Naura	66.67		✓
15	Robi	58.33		✓
AVERAGE		57.7		
PRESENTATION		57.7%	20%	80%

From the table, it can be seen that the results of *the pretest* , namely before giving the action, obtained an average score for student learning achievement of 57.7 and learning completion reached 20% or 3 people out of a total of 15 students who had completed learning.

Table 2. Cycle I *Posttest* Score

No.	Student Name	Mark	Completeness	
			T	TT
1.	Adira	75	✓	
2.	Aira N	66.67		✓
3.	Aira S	100	✓	
4.	Alif	66.67		✓
5.	Alisha	58.33		✓
6.	Azka	66.67		✓
7.	Phase	66.67		✓
8.	Habibie	41.67		✓
9.	Hafiz	66.67		✓
10	Jhafira	83.33	✓	
11	Kenon	58.33		✓
12	Meisya	83.33	✓	
13	Muh. Umam	33.33		✓
14	Naura	75	✓	
15	Robi	66.67		✓
AVERAGE		67.2		
PRESENTATION		67.2%	33.33%	66.67%

Based on the results of the Cycle I *posttest* given after learning using Scratch media, it was found that out of 15 students, only 5 students (33.33%) achieved scores above the

Minimum Completion Criteria (KKM) which is ≥ 70. Meanwhile, 10 students (66.67%) still obtained scores below the KKM. This indicates that classical learning completion has not been achieved, because the percentage of students who have completed is still far below the established success criteria, which is a minimum of 80% of students achieving a complete score. Thus, it can be concluded that the actions in Cycle I have not been optimally successful and still need improvement and reinforcement of the material, especially regarding the understanding of the concept of tens and units, which will be applied in Cycle II.

c) Observation

During the lesson, the teacher and researchers observed student activities, noting their enthusiasm, participation, and any challenges they encountered. Observations revealed that most students were enthusiastic about using Scratch and actively engaged in answering questions. However, some students still struggled to understand how to solve subtraction problems, particularly when borrowing and subtracting numbers in the tens and units columns. This indicates a misconception about place value. (Kurniaman et al., 2021) .

d) Reflection

Based on the results of *the posttest* and observations, it was found that not all students had achieved the KKM. The teacher realized that one of the causes was that many students did not yet understand the concept of place value, namely tens and units, so they were confused when they had to borrow in the process of subtraction. Therefore, in the next cycle, the teacher decided to revise the Scratch media by adding material to reinforce the concept of place value (tens and units) at the beginning of the animation as a basis before students solve subtraction problems. This step is expected to help students understand the subtraction process better in the next cycle. (Logayah, Salira, Kirani, Tianti, & Darmawan, 2023)

Cycle II

a) Planning

In the planning stage of Cycle II, teachers and researchers revised the media and learning strategies based on the reflection results from Cycle I. The main change was the addition of material reinforcing the concept of place value (tens and ones) at the beginning of the lesson. The Scratch media was updated by inserting an interactive section that visually explains the difference between tens and ones using pictures of traditional foods as representations. Evaluation questions in the form of *a posttest* were also prepared with a level of difficulty equivalent to the previous cycle.

b) Implementation of Action (*Action*)

The teacher begins the lesson by reviewing the concept of tens and ones using interactive Scratch media. Once students understand place value, the lesson continues with the topic of subtraction in series. Students are again invited to solve problems using Scratch animations and interactive features, which are now more systematic because they have been adapted to student needs based on the findings from Cycle I. After the practice session, students take *a posttest* individually (Hadzami et al., 2023) .

Table 3. Results of Cycle II Posttest

No.	Student Name	Mark	Completeness	
			T	TT
1.	Adira	91.67	✓	
2.	Aira N	100	✓	
3.	Aira S	100	✓	
4.	Alif	83.33	✓	
5.	Alisha	83.33	✓	
6.	Azka	75	✓	
7.	Phase	75	✓	
8.	Habibie	41.67		✓
9.	Hafiz	75	✓	
10	Jhafira	100	✓	
11	Kenon	100	✓	
12	Meisya	83.33	✓	
13	Muh. Umam	41.67		✓
14	Naura	91.67	✓	
15	Robi	83.33	✓	
AVERAGE		81.67		
PRESENTATION		81.67%	86.67%	13.33%

Based on the results of the Cycle II *posttest* , 13 out of 15 students (86.67%) achieved a score of ≥ 70, thus the learning process was declared to have met the classical completion criteria. Therefore, the actions in this cycle were declared successful and did not need to be continued to the next cycle.

c) Observation

During the implementation of the intervention, observations were made of student activities and the effectiveness of the media. Based on the observations, it appeared that students were more focused and no longer confused about understanding the difference between tens and ones. Their enthusiasm for solving problems also increased. Several previously passive students began to actively ask and answer questions independently. Student interaction with the Scratch media showed that learning became more engaging and easier to understand. (Sampoerna et al., 2022) .

d) Reflection

posttest results in Cycle II showed a significant improvement compared to Cycle I. The majority of students understood the process of multilevel subtraction and were able to solve the problems well. Of the total 15 students, 13 students (86.67%) achieved scores above the Minimum Completion Criteria (KKM), while only 2 students (13.33%) had not yet completed the task. This means that the learning process has met the classical completion criteria, namely at least 80% of students achieving the Minimum Completion Criteria (KKM). With the achievement of these success indicators, the actions in Cycle II were declared successful and the research was stopped at this cycle.

Discussion

This classroom action research aims to improve the understanding of the concept of layered subtraction in second-grade students of SD Negeri 066055 Medan Denai through the use of Scratch media developed with a *Culturally Responsive Teaching* (CRT) approach. The results of the study indicate an increase in student learning outcomes from pre-action to Cycle II implementation. (Simatupang, 2024) .

In Cycle I, the *posttest results* showed that most students had not achieved the Minimum Completion Criteria (KKM) set, which was 70. This indicates that there are still obstacles in understanding basic concepts, especially in place value (tens and units), which greatly influences success in solving multiplication problems. Weaknesses in understanding place value result in students having difficulty when carrying out the subtraction process using the borrowing technique. (Khasanah et al., 2023) .

As a follow-up, in Cycle II, learning was improved by adding material reinforcing the concept of place value into the Scratch media. The teacher also facilitated a deeper exploration of how layered subtraction works through clearer visual and interactive features. As a result, student understanding improved significantly. Thirteen out of 15 students (86.67%) successfully achieved a passing grade. This indicates that the modified learning approach with the CRT approach—which connects the subject matter to a cultural context familiar to students—contributed to increasing their engagement and understanding.

Culturally Responsive Teaching approach encourages teachers to adapt their teaching methods to the cultural backgrounds of their students. Gay (Pebriyani & Pahlevi, 2020) emphasized that CRT allows teachers to utilize the characteristics and experiences of

students from diverse ethnicities as the basis for learning strategies. In this study, the use of visual elements of traditional foods familiar to students' daily lives serves as a link between their real world and abstract mathematical concepts. (Purba & Halim, 2025) .

Thus, culturally responsive digital media-based mathematics learning has proven effective in improving students' conceptual understanding, particularly in procedural skills such as multiplication. The success of the Cycle II approach demonstrates that integrating the CRT approach into learning media such as Scratch can be an innovative solution to addressing mathematics learning difficulties at the elementary school level.

CONCLUSION

Based on the results of classroom action research that has been carried out in two cycles, it can be concluded that the use of Scratch media with the Culturally Responsive Teaching (CRT) approach can improve the understanding of the concept of layered subtraction in class II students of SD Negeri 066055 Medan Denai.

In cycle I, learning was not fully successful because most students did not understand the concept of place value (tens and ones), which resulted in low posttest results. However, after improvements were made in cycle II, including reinforcement of place value material and adjustments to more contextual and interactive Scratch media, student learning outcomes significantly improved.

This improvement is evident in the number of students achieving the Minimum Completion Criteria (KKM), which increased from 40% in cycle I to 86.67% in cycle II. Thus, the CRT approach, which integrates cultural elements into learning media, has been proven to improve the effectiveness of mathematics learning, particularly in understanding the concept of nested subtraction.

Suggestion

1. For Teachers: Teachers are advised to use interactive and contextual learning media, such as Scratch combined with the CRT approach, to help students understand basic mathematical concepts more easily.
2. For Schools: Schools are expected to support digital-based learning innovations and local culture to improve the quality of learning, particularly in the context of implementing the Independent Curriculum.
3. For Future Researchers : This research can serve as a reference for developing similar learning media for different materials or levels. Further research is recommended to examine the effect of CRT on other aspects, such as students' learning attitudes or critical thinking skills

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