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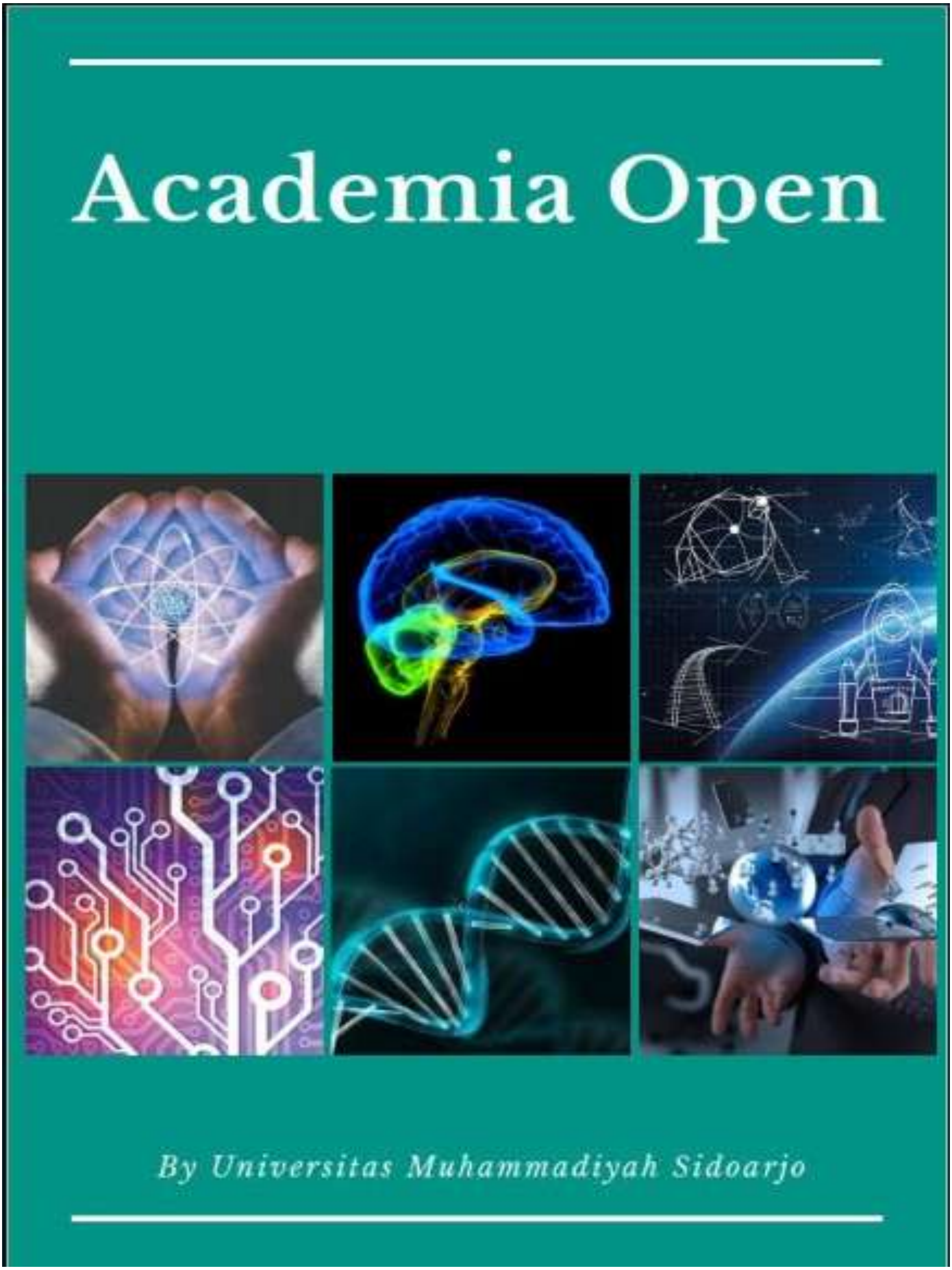

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Contextual Teaching And Learning Supports Mathematics Mastery In Students With Difficulties: Model Pembelajaran Kontekstual Mendukung Penguasaan Matematika Siswa Berkesulitan Belajar

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Abstract

General Background Mathematics instruction requires concrete and meaningful learning experiences to build conceptual understanding rather than merely focusing on procedural calculations. **Specific Background** Fifth-grade students at risk of learning difficulties at SD Negeri 002 Sangatta Selatan struggle significantly with abstract whole-number concepts when exposed to traditional, lecture-based teaching methods. **Knowledge Gap** Previous literature predominantly focuses on typically developing students and isolated concrete strategies, leaving a lack of empirical evidence regarding the complete seven-component Contextual Teaching and Learning model for whole-number conceptualization among students with learning challenges. **Aims** This study describes the implementation of the complete Contextual Teaching and Learning model and evaluates its capacity to facilitate mathematics mastery for fifth-grade students with learning difficulties. **Results** Classroom Action Research across two cycles demonstrated that student mathematics scores advanced from pre-action levels of 28 percent and 30 percent to 80 percent and 82 percent in the final cycle, successfully exceeding the 70 percent minimum mastery criterion. Furthermore, observational data confirmed continuous advancements in student classroom participation, teacher performance, and instructional fidelity. **Novelty** This research distinctly integrates all seven contextual instructional components with concrete manipulatives to simultaneously assess academic achievement and classroom process quality in an inclusive elementary setting. **Implications** Educators should adopt authentic contextual simulations and concrete instructional media to accommodatediversecognitive needs and foster meaningfulmathematical understanding in inclusive classrooms.

Highlights

- Contextual simulations combined with concrete manipulatives successfully support conceptual mathematics mastery.
- Implementing the seven contextual learning components substantially advances student classroom participation.
- Authentic learning environments facilitate the transition from concrete experiences to abstract mathematical reasoning.

Keywords

Contextual Teaching And Learning; Mathematics Mastery; Learning Difficulties; Concrete Instructional Media; Inclusive Elementary Education

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INTRODUCTION

Mathematics is one of the basic subjects which play a key role towards the development of students' numeracy skills, logical reasoning, problem solving skills and decision making in everyday life. At elementary school level, the mastery of mathematical concepts becomes the basis for further learning. Therefore, mathematics learning should be designed systematically to provide meaningful learning experiences based on the characteristics of students according to their development. The emphasis in learning mathematics should not be on procedural calculations, but should also develop conceptual understanding and the ability to apply mathematical knowledge in real situations. Therefore, the learning experiences should be concrete and meaningful in order to facilitate students' understanding of abstract mathematical concepts. This need is even more pressing for students at risk of learning difficulties. Students who are identified as eligible under this category typically show limitations in intellectual functioning and adaptive behaviour that affect their capacity to think abstractly, problem solve, retain information, and transfer knowledge to different situations. These characteristics require instructional approaches that are concrete, sequential, repetitive, and closely related to students' daily experiences. Mathematics instruction that is characterised by verbal explanations or abstract symbols, without meaningful contexts, often becomes difficult to understand for these students, leading to low achievement in learning and limited opportunities to develop essential numeracy skills.

Cognitive limitations pose significant challenges for students with learning difficulties in forming mental representations of abstract concepts. They are good learners when knowledge is delivered through concrete objects, visual media, hands-on activities and real-life situations. Accordingly, mathematics instruction for students at risk of learning difficulties must focus on contextualised learning experiences that guide students through a progression to abstract conceptual understanding from concrete experiences. Based on the initial observations at SD Negeri 002 Sangatta Selatan, there were significant difficulties faced in teaching mathematics for the students of grade V with the potential of learning difficulties. Participants were two 12 and 13-year-old students who experienced significant difficulty with whole number concepts, specifically place value and number comparison. When teachers used a highly verbal teaching style or a lecture-based teaching style during classroom instruction, students responded slowly. They had difficulty in understanding the mathematical symbols, quickly lost concentration and could not relate the mathematical concepts to real life situations. Therefore, their learning outcomes of mathematics are still below the Minimum Learning Mastery Criteria of the school. Conversely, classroom observations revealed that both students displayed high levels of engagement and enthusiasm when teachers employed concrete manipulatives, colourful visual media, and hands-on activities. They had longer attention spans, more active classroom participation, and a better understanding of the concepts being taught. These results indicate that the students' learning characteristics are more suited for contextual and experiential instruction than traditional teacher-centered instruction.

One of the teaching models that is in line with these learning characteristics is Contextual Teaching and Learning (CTL). CTL is a learning model that relates academic content to the real experience of students so that learners can build knowledge through meaningful interaction with their environment. The model is developed around seven basic elements: constructivism, inquiry, questioning, learning community, modelling, reflection and authentic assessment. These elements motivate students to learn actively through observation, discussion, collaboration, exploration and problem solving, making learning more meaningful. Learning activities involving concrete objects and familiar contexts are intended to aid students at risk of learning difficulties in moving from concrete to abstract mathematical understanding. Previous studies have shown that CTL model is effective in improving mathematics learning. In a study by Sanjaya (2018), CTL significantly increased elementary school students' mathematics achievement by relating mathematical concepts to real life experiences. Wahyuni (2019) states that contextual learning was effective in improving students' comprehension of mathematical concepts with mild learning difficulties because the learning was based on direct experiences. Pratiwi (2020) also found that concrete instructional approaches had a positive effect on the mastery of mathematics concepts by students with learning difficulties. Moreover, Rahmawati (2021) proved that contextual learning through Classroom Action Research greatly increased students' achievement in the field of mathematics with learning difficulties in two cycles of learning.

However, some research gaps remain despite these promising findings. First, the majority of CTL research has focused on typically developing students, with limited empirical evidence on its effectiveness for students at risk for learning difficulties. Second, research on students with learning difficulties has tended to focus on concrete instructional strategies and not the full seven component framework of the CTL model. Third, although the focus of previous research has been on general mathematics achievement, there is still a lack of research on whole-number concepts among fifth-grade students at risk of learning difficulties. Finally, prior research has mostly focused on student learning outcomes, with little attention to changes in instructional processes, such as student participation, the fidelity of CTL implementation, and teacher performance during classroom instruction. To fill these gaps, the present study makes a new contribution by implementing the complete Contextual Teaching and Learning (CTL) model through its seven instructional components to improve the quality of the learning process and mathematics learning outcomes among fifth grade students at risk of learning difficulties. Unlike previous studies, this study not only evaluates students' academic achievement but also changes in classroom participation, the quality of implementation of the CTL model, and teacher performance during the intervention, thus providing a more comprehensive understanding of the effectiveness of CTL in inclusive elementary mathematics education. Therefore, this study aims to describe the implementation of the Contextual Teaching and Learning (CTL) model and to determine its effectiveness in improving mathematics learning outcomes of fifth-grade students at risk of learning difficulties. It is expected that the findings will contribute to the development of adaptive mathematics instructional practices for students with special educational needs and provide practical guidance for elementary school teachers in designing more meaningful, contextual, and inclusive mathematics learning environments.

METHOD

This study used Classroom Action Research (CAR) with Kemmis and McTaggart model which consists of four cycle stages, namely planning, action, observation, and reflection. This research was carried out at SD Negeri 002 Sangatta Selatan, East Kutai Regency, East Kalimantan, Indonesia in the 2025/2026 academic year. The participants were two fifth-grade students who were identified as at risk of learning difficulties through purposive sampling based on teachers' recommendations and classroom observations. Selected students demonstrated ongoing difficulties in conceptual understanding of mathematics, slow cognitive processing relative to peers, and need for intensive instructional support during mathematics learning. This research was conducted in two action cycles. Each cycle was aimed to improve students' learning result of mathematics through the Contextual Teaching and Learning (CTL) model. The instructional intervention was based on the seven core components of the Contextual Teaching and Learning (CTL) model which are constructivism, inquiry, questioning, learning community, modelling, reflection and authentic assessment. The learning activities were based on the use of concrete objects and real-life situations to facilitate students' development of conceptual understanding of mathematics. Each cycle comprised lesson planning, classroom implementation, systematic observation and reflective evaluation. The results of the first cycle were used to modify instructional strategies prior to the implementation of the second cycle, allowing for continuous improvement throughout the research process.

Data were collected through tests of mathematics learning outcomes, classroom observations, interviews and documentation. At the end of each cycle, mathematics achievement tests were given to assess students' learning outcomes. Observation sheets were utilised to assess student participation, teacher performance, and the fidelity of CTL implementation. Further information about learning difficulties and students' responses to the intervention was gathered through interviews with the classroom teacher and participating students. Supporting documents such as lesson plans, students' worksheets, photographs of classroom activities and assessment records were also collected to triangulate the data and thus to consolidate the research findings. The validity of the instrument was determined by expert judgement. Reliability was ensured by maintaining the consistency of the observation procedures and the implementation of the assessment during the study. The collected data were analysed using descriptive quantitative methods. The students' mathematics learning outcomes were analysed by calculating individual scores, mean scores, and the percentage of learning mastery in the pre-action stage, Cycle I, and Cycle II. Descriptive analysis was done to see the change of student participation, teacher performance, and quality of the implementation of the CTL model in each cycle, using observation data. Triangulation of sources and methods enhanced the credibility of the study, which involved comparing information gathered from classroom observations, achievement tests, interviews, and documentation. The study was declared successful if the students continuously improved in mathematics learning outcomes and met the school's Minimum Learning Mastery Criteria, along with the positive improvements in classroom participation and instructional implementation.

RESULT AND DISCUSSION

Pre-Action Findings

Before the intervention was conducted, preliminary observation and diagnostic test were given to know the initial mathematics skills of the fifth grade students of SD Negeri 002 Sangatta Selatan. The class contained 23 students, two identified as at risk of learning difficulties (AB and PA) and 21 typically developing students. The pre-action assessment was administered on April 16, 2026. The assessment focused on basic mathematical skills including number recognition, counting, place value, and conceptual understanding of whole numbers. Results indicated that most of the typically developing students had already achieved the competencies assessed. Sixteen students scored in the Very Good category (90-100%) and five students scored in the Good category (80-89%). These students were able to correctly recognise and sequence numbers, identify place values appropriately and solve basic conceptual mathematics problems with little difficulty. Overall, the class demonstrated adequate mastery of the learning objectives, suggesting that traditional classroom instruction was generally effective for most students.

On the other hand, the two students who were at risk for learning difficulties showed much lower achievement as compared to other students in the class. Student AB scored 30% and student PA scored 28% and both are in the Poor category. Classroom observations during the assessment indicated that both students had significant difficulty recognising number symbols, counting objects in sequence, and understanding the concepts of ones and tens. Children struggled to understand what numbers meant. They required constant help from teachers in order to do even simple maths. They mixed up number symbols. Specifically, student AB could verbally recite numbers, but had extreme difficulty symbolically representing numbers, especially in distinguishing place values. For example, the student often wrote incorrect number combinations because the idea of tens and ones was not yet internalised. Similarly, problems were also observed for student PA in the visual recognition of number and in one-to-one correspondence in counting activities. The student often omitted numbers when counting objects and could not follow abstract mathematical directions without explicit instruction and concrete learning materials.

The big difference in learning between the 21 normally developing students and the two students at risk for learning difficulties indicates that the teaching method used did not adequately address the diverse learning needs. Because of their lack of abstract reasoning skills, AB and PA could not benefit from traditional teacher-centered teaching, which was mostly based on verbal explanations and symbolic representations and was adequate for most students. Findings suggest that the two students needed differentiated instruction that focused on concrete experiences, repetitive practice, simplified learning tasks, and direct manipulation of learning materials to help them to develop conceptual understanding. Therefore, the pre-action findings provided a valid basis for the implementation of the Contextual Teaching and Learning (CTL) model in the next cycles of intervention. The intervention was conceived to make connections between students' understanding of concrete representations and abstract mathematical concepts by using concrete objects, real-life situations, and meaningful

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learning experiences . The intervention was specifically designed to help students master number recognition, place value, and conceptual understanding of whole numbers.

Implementation of Cycle I

The Cycle I action was carried out in three meetings, which included two instructional meetings and one post-action test. Before doing the action, the researcher prepared lesson modules, mathematics materials on whole numbers, place value, and number comparison, and concrete learning media such as wooden sticks and play money. The researcher also made observation sheets for student activities, observation sheets for CTL implementation, and tests for learning outcomes. All learning activities were designed based on the stages of Contextual Teaching and Learning (CTL) i.e. constructivism, inquiry, questioning, learning community, modelling, reflection and authentic assessment. In the first meeting, the lesson was devoted to the introduction of whole numbers, place value and number comparison through activities related to students' daily experiences. The teacher began the lesson with contextual questions on shopping and saving money to activate students' prior knowledge. Then students used concrete media such as wooden sticks, coloured marbles and play money to represent ones, tens and hundreds. Through exploration, group discussion and teacher modelling, students began to develop an understanding that the value of a number is determined by its place in the place value system. The second meeting lesson was aimed at strengthening the students' concept of place value to hundreds and their ability to compare bigger numbers. The teacher used sticks and play money as concrete representations to help students learn the relation between quantity and number symbol. The learning activities were grouping sticks into tens and hundreds, solving simple simulations of price comparisons and small group discussions to determine the right comparison symbols. The third meeting was a post action test of Cycle I to measure students' understanding of mathematics after learning through the CTL model supported concrete media.

To get a more comprehensive understanding of the effectiveness of the Cycle I then observations were made on student activities, the implementation of the model Contextual Teaching and Learning (CTL), and teacher performance during the learning process. The results of the observation were used for evaluating the quality of the learning process and for finding the required improvements for the next cycle.

Table 1. *Observation Results of CTL Implementation in Cycle I*

Observation Session	Maximum Score	Obtained Score	Percentage
Meeting 1	40	32	66%
Meeting 2	40	39	81%
Average			**73%**

Table 1 shows that the quality of implementation of Contextual Teaching and Learning (CTL) models increased during Cycle I. In the first meeting, the implementation score was 66% in which most of the instructional procedures had been implemented properly and there were some learning stages that still needed to be refined. In the second meeting implementation score was 81%. It indicates the great improvement in the classroom management and the execution of the CTL instructional procedures. Overall, the mean implementation score of 73% shows that the learning activities were implemented well based on the principles of the CTL model. The improvement could be seen in the teacher's ability to relate mathematical concepts with students' daily experiences, by using concrete learning materials like wooden sticks and play money. Instead of being given mathematical symbols, students first worked with concrete objects and then wrote down in numbers what they noticed about them. The teaching method provided a more meaningful mathematics learning experience for students as they developed a conceptual understanding of place value and number comparison through authentic learning experiences rather than memorising mathematical procedures.

Student participation was observed during both instructional meetings to examine students' engagement and responses while participating in mathematics learning through the Contextual Teaching and Learning (CTL) model.

Table 2. *Student Participation Observation Results in Cycle I*

Student	Meeting 1	Meeting 2	Average
PA	57%	61%	59%
AB	59%	63%	61%

Table 1 shows that the quality of implementation of the models of Contextual Teaching and Learning (CTL) increased during Cycle I. In the first meeting, the implementation score was 66%. Most of the instructional procedures have already been implemented properly, and there are some learning stages that need to be refined. The score of implementation in the second meeting was 81% It indicates the great improvement in classroom management and implementation of the CTL instructional procedures. The mean implementation score of 73% generally indicates that the learning activities were well implemented according to the principles of the CTL model. The improvement could be seen in the teacher's ability to relate the mathematical concepts with the students' daily experiences, through the use of concrete learning materials such as wooden sticks and play money. The students were given concrete objects, not mathematical symbols, and then in numbers recorded what they observed about them. The teaching method gave students a more meaningful maths learning experience by providing them with a conceptual understanding of place value and number comparison through authentic learning experiences, rather than memorising mathematical procedures.

At the end of Cycle I, students were tested using a mathematics achievement test to assess their knowledge of whole numbers, focusing on place value and number comparison. The learning activities of the cycle were elaborated from the seven components of the Contextual Teaching and Learning (CTL) model. Students used wooden sticks to model mathematical concepts of ones and tens. They engaged in group activities like class shopping simulations. They observed

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teacher demonstrations that employed play money and comparison symbols. They also undertook authentic assessment tasks that evaluated both the processes and outcomes of learning.

Table 3. *Mathematics Learning Outcomes in Cycle I*

No.	Student	Maximum Score	Obtained Score	Percentage
1	PA	60	39	65%
2	AB	60	40	67%

Table 3 shows that students' mathematics achievement has been increased after the use of the CTL model. Student PA scored 39 out of 60 points (65%) Student AB scored 40 out of 60 points (67%) Based on the pre-established criteria for achievement both students fell into the category of Fair. Although the results were significantly improved from the pre-action condition, neither student met the school's Minimum Learning Mastery Criteria of 70%. The results showed that the use of the CTL model in Cycle I improved the students' conceptual understanding of place value and number comparison but further instructional refinement was still needed in order to achieve the desired level of learning mastery. Therefore the research was continued to Cycle II to improve the student's mathematical understanding through better contextual learning activities.

The implementation of Cycle I shows that the Contextual Teaching and Learning (CTL) model assisted by concrete learning media such as wooden sticks and play money has a positive contribution to students' learning of mathematics. The result of the post-test showed that PA of the students reached 65% and student AB was 67%. However, both are still in the Fair category and are below the predetermined success criterion of 75%. Both scores have improved significantly compared to the pre-action condition . The results indicate that concrete manipulatives helped students better understand place value and number comparison by linking abstract mathematical ideas to meaningful real-life experiences.

Table 4. *Comparison of Pre-Action and Cycle I Mathematics Learning Outcomes*

No.	Student	Pre-Action	Cycle I	Improvement
1	PA	28%	65%	37%
2	AB	30%	67%	37%

Table 4 shows that the students in each group have an equal increase, which is 37 percentage points, from the pre-action assessment to the end of Cycle I. This was a major improvement, however, neither participant reached the predetermined criterion for success which suggested that further instructional modification was necessary. The findings confirmed that while the CTL model was successful in improving students' initial conceptual understanding of mathematics, additional support was necessary to facilitate the transition from concrete experiences to symbolic mathematical representations.

Reflection process showed number of challenges which hindered the learning outcomes of students in Cycle I. Both students still had difficulties in interpreting abstract mathematical symbols especially the comparison symbols (<, >, =) although both showed better understanding when working with concrete materials. Secondly, the fact that all contextual learning activities were completed within the classroom reduced student engagement over time, and a more authentic learning environment would better support the Learning Community component of the CTL model. Third, the inquiry-based activities and manipulation of learning media needed better time management because students often became deeply engaged with the materials before the planned learning objectives were completed. These findings made some improvements planned for Cycle II, including: making mathematics symbols more accessible to students through simple analogies, redesigning the learning environment into a mini-school store to provide more realistic contextual experiences, and improving instructional time management to enhance student engagement and learning effectiveness.

Implementation of Cycle II

As a follow-up of the reflection results obtained from Cycle I, Cycle II was conducted. The instructional modifications were intended to address the limitations found in the previous cycle, particularly the students' difficulties in understanding mathematical comparison symbols, sustaining attention during the lesson, and relating abstract mathematical concepts to real-life learning experiences. The intervention consisted of three meetings, two of which were instructional and the third was an assessment after the action, on April 30, May 4, and May 7, 2026. The learning activities were still using the Contextual Teaching and Learning (CTL) model but with several improvements that were expected to improve students' conceptual understanding and classroom engagement. The learning activities in Cycle II emphasised a more authentic and contextual learning environment. At the beginning of each lesson students were stimulated by discussing everyday shopping experiences and then grouped into small heterogeneous groups. Each group received learning materials of wooden sticks and play money to support understanding of place value and number comparison. Unlike Cycle I, some learning activities took place outside the classroom in a mini-school store set up on the school terrace. Students were required to use bundles of wooden sticks to represent numbers, match the prices of different snacks and drinks with the correct denominations of play money and compare different prices in real life purchasing situations. These activities provided the opportunity for the learners to develop mathematical concepts through direct contact with concrete objects and real situations.

Some instructional improvements were also introduced in ord er to solve the problems found in Cycle I. The teacher used a simple analogy called the "chicken beak analogy" to help the students understand the comparison symbols. The pointed end of the comparison symbol (< or >) was said to be the beak of a chicken pecking toward the smaller number. This analogy turned abstract mathematical symbols into meaningful visual representations that were more accessible to students with learning difficulties. Positive reinforcement like verbal praise, thumbs up, and high-fives were given on a regular basis to boost students' motivation and confidence during the learning process. The authentic assessment was done on a continuous basis by observing the students as they manipulated the concrete materials, identified the place values, and correctly used the comparison symbols in the shopping simulation. At the end of Cycle II, a mathematics achievement test was administered to determine the conceptual understanding of the students after the implementation of the improved CTL instruction. The research measured students' mastery of whole numbers, place value, and number comparison after they participated in contextual learning activities using concrete media. The assessment results were expected to show if the instructional adjustments made in Cycle II were effective in addressing the learning difficulties identified in the previous cycle and enabled students to achieve the learning mastery standard that was set.

Classroom observations were made during the learning process to see the effectiveness of instructional improvement made in Cycle II. The observations were to focus on students' participation, teacher's performance and fidelity of Contextual Teaching and Learning (CTL) model in the instruction. The results of the observation are a comprehensive evidence about the quality of the learning process and constitute the basis for the evaluation of the effectiveness of the intervention in Cycle II.

Table 5. *Pretest Results of Students' Interpersonal Communication*

Student	Meeting 1	Meeting 2	Average
PA	80%	92%	86%
AB	87%	95%	91%

The student participation in Cycle II was significantly improved as shown in Table 5. Student PA averaged 86% on participation in the two meetings (80, 92%). Likewise, student AB received scores of 87% and 95% for participation, which averaged 91%. Both students demonstrated increased engagement and independence during the learning activities compared to Cycle I. Also, qualitative observations showed significant improvements in students' understanding of mathematics and in their classroom behaviour. Both students improved their ability to use wooden sticks to represent place value, compare numbers using shopping transaction simulations, and communicate mathematical reasoning in group discussions. The use of play money in setting up the Mini School Store gave real experiences of learning and encouraged students to be actively involved in solving contextual mathematical problems. Furthermore, the "chicken beak" analogy was effective in helping students distinguish the mathematical comparison symbols (<, >, =) and preventing the confusion found during Cycle I. Contextual learning environment had an overall effect of increasing students' motivation, confidence and active participation during mathematics instruction.

The result of observation showed that the teacher was able to implement all stages of Contextual Teaching and Learning (CTL) model on the second Cycle. The teacher skilfully combined constructivism, inquiry, questioning, learning community, modelling, reflection, and authentic assessment into every learning activity, while making the most of the use of wooden sticks and play money as concrete instructional media. The learning activities were systematically arranged to enable the students to develop the mathematical concepts by direct interaction with the significant real-life situations. The teacher also showed good classroom management by creating an active, student-centred and fun learning environment. The implementation of learning activities in the Mini School Store outside the classroom raised students' attention and reduced the boredom which was observed in Cycle I. Their constant encouragement, positive reinforcement and personalised approach enabled both students to participate with greater confidence and independence throughout the learning process. Therefore, teacher performance played a significant role in improving the mathematics achievement of students during Cycle II.

At the end of Cycle II, a post-action mathematics achievement test was administered to determine students' mastery of place value and number comparison after the improved implementation of the CTL model.

Table 6. *Comparison of Mathematics Learning Outcomes Between Cycle I and Cycle II*

No.	Student	Cycle I	Cycle II	Improvement
1	PA	65%	80%	15%
2	AB	67%	82%	15%

As seen in Table 6, both students showed consistent improvement in mathematics learning outcomes after the implementation of Cycle II. Student PA went from 65% in Cycle I to 80% in Cycle II, and student AB went from 67% to 82%. The improvement of both students was 15 percent points. This proved that the instructional modifications implemented in Cycle II were successful in improving the students' conceptual understanding of mathematics. More importantly, both students have passed the Minimum Learning Mastery Criteria of the school (70%), hence the intervention has successfully met the predetermined success criterion. The better learning outcomes indicate that the combination of contextual learning experiences and concrete instructional media have been successful in helping students grasp abstract mathematical concepts. Students related mathematical knowledge to real-life situations through the activities involving the Mini School Store, wooden sticks and play money for meaningful learning and better retention of concepts.

Cycle II was the last stage of the classroom action research and was done to evaluate the overall effectiveness of the improvements made after the reflection of Cycle I. The reflection was a collaborative discussion between the researcher and the classroom teacher about classroom observations, student participation, teacher performance and mathematics learning outcomes. The findings revealed the instructional modifications made during Cycle II effectively corrected the deficiencies identified during the prior cycle. Students demonstrated more involvement, more excitement in learning activities, and better grasp of place value and number comparison by employing concrete learning materials inserted into authentic contextual scenarios. The implementation of the Contextual Teaching and Learning (CTL) model also provided a more engaging and meaningful learning environment for students at risk of learning difficulties. Mini School Store learning activities, supported by play money and wooden sticks, provided students opportunities to connect abstract mathematical concepts to familiar real-life experiences. As a result, students were more active in participating in classroom discussions,

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more confident in solving mathematical problems, and more independent in completing learning tasks than in the previous cycle. The findings imply that the contextual learning along with the concrete instructional media was effective to promote the development of students' mathematical understanding.

Table 7. *Summary of Mathematics Learning Outcomes from the Pre-Action Stage to Cycle II*

Student	Minimum Learning Mastery Criteria	Pre-Action	Cycle I	Cycle II
		Score (%)	Score (%)	Score (%)
PA	70%	11 (28%)	39 (65%)	48 (80%)
AB	70%	12 (30%)	40 (67%)	49 (82%)

As shown in Table 7, the mathematics learning outcomes of both students improved continuously during the intervention. The pre-action stage student PA was 28% and student AB was 30%. It indicates that students have limited conceptual understanding of mathematics. After the implementation of Cycle I, the students improved significantly with the percentage of 65% and 67% respectively. These results showed some progress, but neither student reached the school's Minimum Learning Mastery Criteria (70%), indicating the need for further instructional refinement. After implementation of the enhanced instructional strategies in Cycle II, student PA's achievement increased to 80% and student AB achieved 82%, an additional increase of 15 percentage points for both students compared to Cycle I. Both participants successfully exceeded the mastery criterion, indicating that the refined implementation of the Contextual Teaching and Learning (CTL) model could effectively improve the mathematics learning outcomes of fifth-grade students at risk of learning difficulties.

Discussion

The results of this study show that the implementation of the Contextual Teaching and Learning (CTL) model can improve the mathematics learning outcomes of grade V students with the risk of learning difficulties. Improvements were visible throughout the entire intervention, from pre-action stage through Cycle I to the predetermined mastery criteria in Cycle II. Student PA's achievement increased from 28% at the pre-action stage to 65% at Cycle I and 80% at Cycle II, while student AB's achievement increased from 30% to 67%, and finally to 82%. The implementation of CTL was not only improving the learning result but also the student participation, classroom activities, and learning motivation, indicating that the contextual learning approach supported the cognitive and behavioural sides of the learning of mathematics. The findings indicate that authentic situation-based learning experiences are more conducive to the construction of mathematical concepts than traditional teacher-centered instruction for students with learning difficulties. The constructivist learning theory perspective can account for the effectiveness of the CTL model. Jean Piaget thought that knowledge is actively constructed through interaction with the environment, not passively received from teachers. Students in the concrete operational stage learn concepts best if they have handled real objects before being presented with abstract representations. This theoretical perspective is particularly relevant for students with risk of learning difficulties, whose cognitive development requires concrete experiences to facilitate conceptual understanding. The students were able to relate the mathematical symbols to real-world experiences using wooden sticks, play money, and the Mini School Store simulation and therefore they were able to transfer from concrete manipulation to symbolic reasoning. This finding is in line with the findings of Ibda (2018) and Pujadi et al. (2021) who argue that the concrete learning experience is needed for elementary school students to understand the abstract mathematical concepts. Similarly, Mumpuniarti (2007) states that students with learning difficultiesneed instructional methods that are suitable for their cognitive characteristics and their adaptive functioning.

The improvement in mathematics achievement was also related to the meaningful integration of mathematical concepts in the students' daily experiences. Instead of just memorising procedures and formulas, students were actively exploring mathematical relationships as they counted wooden sticks, identified place values, compared prices, and engaged in simulated shopping. These authentic experiences allowed the students to understand the practical meaning of mathematics in daily life and therefore enhance conceptual retention. This result is in line with Rusman (2012) which states that contextual learning facilitates the construction of knowledge meaningfully through authentic experiences, and Joyce and Weil (2003) who define instructional models as systematic frameworks that lead to meaningful learning experiences. Furthermore, the results are consistent with Wahyudi and Winanto (2018) which stated that concrete instructional media can assist students to shift from enactive experiences to symbolic mathematical understanding. Another important finding is the significant increase in students' classroom participation in Cycle II. The contextual learning environment with the support of manipulative materials and collaborative activities allowed the students to be more actively involved in discussion, problem solving and mathematical communication. Students were more confident in expressing ideas, manipulating learning materials, and completing mathematical tasks independently, in comparison to the passive learning behaviours demonstrated before the intervention. These findings are consistent with the research of Kurniawati et al. (2020) and Smith et al. (2023) who found that concrete and manipulative learning media can significantly improve the engagement of students with learning difficultiesby transforming the learning process from passive listening to active participation. In addition, Pratiwi et al. (2021) and Susilawati (2020) also mentioned that physical interaction with concrete objects stimulates sensory and cognitive processes that improve conceptual understanding for students with special educational needs.

The modifications to instruction introduced in Cycle II also contributed importantly to students' learning success. The implementation of the Mini School Store as a real life learning environment and the use of the "chicken beak" analogy to explain comparison symbols were effective in overcoming the limitations identified in Cycle I. These improvements allowed students to understand abstract mathematical symbols with familiar visual representations and simultaneously increased their motivation and attention to the learning activities. The findings suggest that the best support of contextual learning is through authentic context, meaningful analogies, and concrete instructional media that are aligned with students' cognitive characteristics. This study provides empirical evidence that the Contextual Teaching and Learning (CTL) model is an

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effective instructional approach in improving mathematics learning outcomes of elementary school students at risk of learning difficulties. The model improved the students' academic achievement above the school's Minimum Learning Mastery Criteria, the students' active participation, conceptual understanding and learning motivation. These findings build on previous research by showing how the combination of contextual learning, concrete media and authentic learning environments can successfully bridge the gap between concrete experiences and abstract mathematical concepts for students with learning difficulties. Thus, CTL provides a promising instructional alternative for inclusive elementary mathematics education and may provide a practical reference for teachers who want to plan meaningful and accessible learning experiences for students with diverse learning needs.

CONCLUSION

The results of this study indicate that the implementation of Contextual Teaching and Learning (CTL) model is effective to improve the learning outcomes of mathematics for fifth grade students at risk of learning difficulties at SD Negeri 002 Sangatta Selatan. Contextual learning activities with the support of concrete instructional media such as wooden sticks, play money, and the Mini School Store simulation provided meaningful real-life experiences that allowed students to understand abstract mathematical concepts related to place value and number comparison. The students' mathematics achievement increased from the pre-action stage (28% and 30%) to Cycle I (65% and 67%) and to Cycle II (80% and 82%). The students' mathematics achievement was above the school's Minimum Learning Mastery Criteria. The implementation of the CTL model not only enhanced the learning outcomes but also increased the students' participation, motivation, and engagement during the instructional process, indicating that contextual and concrete learning experiences are beneficial in promoting mathematics learning among students at risk of learning difficulties. Based on the results of this research, it is suggested that the Contextual Teaching and Learning (CTL) model can be an alternative model of learning in learning mathematics for students at risk of learning difficulties in inclusive elementary schools. Teachers are encouraged to combine contextualised learning experiences and concrete instructional media that are closely related to the students' daily lives to facilitate conceptual understanding and increase learning motivation. Schools should support the implementation of CTL by providing sufficient manipulative learning materials and authentic learning resources that promote meaningful mathematics teaching. Future studies are recommended to test the efficiency of the CTL model with larger sample sizes, varied mathematical topics, and different categories of students with special educational needs to improve the generalisability of these findings and further enrich inclusive mathematics education practices.

References

1. Anni, A. (2020). Karakteristik kognitif individu dengan hambatan intelektual ringan. Jurnal Pendidikan Khusus, 15(2), 120–135.
2. Arikunto, S., Suhardjono, & Supardi. (2015). Penelitian tindakan kelas. Bumi Aksara.
3. Arsita, P. W. (2024). Pengembangan instrumen penilaian berbasis kompetensi dalam pembelajaran modern. Jurnal/Prosiding Edutama Jaya.
4. Boon, R. T., Burke, M. D., & Fore, C. (2019). Multisensory strategies for teaching mathematics to students with intellectual and developmental disabilities. Journal of Special Education Technology, 34(2), 115–128. https://doi.org/10.1177/0162643418811234
5. Damayanto, A., Ishartiwi, I., Handoyo, R. R., & Purwandari, E. (2021). Kondisi Pemenuhan Teknologi Asistif Bagi Anak Berkesulitan Belajar Spesifik (ABBS) di Sekolah. Jurnal Ortopedagogia, 7(1), 62-67.
6. Depdiknas. (2013). Pendekatan kontekstual (Contextual Teaching and Learning). Direktorat Jenderal Pendidikan Dasar dan Menengah.
7. Hamalik, O. (2017). Kurikulum dan pembelajaran. Bumi Aksara.
8. Hammill, D. D., & Bryant, B. R. (2021). Learning Disabilities: Characteristics and Instructional Approaches. New York: Routledge.
9. Handoyo, R. R. (2022). Akomodasi Kurikulum dan Strategi Pembelajaran Spesifik bagi Anak Berisiko Hambatan Belajar. Jurnal Pendidikan Luar Biasa UNY, 17(2), 115-128.
10. Ibda, F. (2018). Perkembangan kognitif: Teori Jean Piaget. Intelektualita: Jurnal Keagamaan dan Ilmu Pendidikan, 5(1), 27–38.
11. Ishartiwi. (2021). Pencegahan dan Intervensi Dini Hambatan Belajar pada Anak Usia Sekolah Dasar. Yogyakarta: UNY Press.
12. Ishartiwi. (2021). Pencegahan dan Intervensi Dini Hambatan Belajar pada Anak Usia Sekolah Dasar. Yogyakarta: UNY Press.
13. Jasiah, J., Mirnawati, M., & Rahman, A. (2021). Evaluasi pembelajaran: Konsep dasar, prinsip, dan teknik penilaian dalam dunia pendidikan. Deepublish.
14. Komalasari, K. (2013). Pembelajaran kontekstual: Konsep dan aplikasi. Refika Aditama.
15. Kurniawati, A., Sugiman, S., & Rosnawati, R. (2020). Efektivitas penggunaan media manipulatif terhadap motivasi dan hasil belajar matematika siswa berkebutuhan khusus. Jurnal Elemen, 6(2), 245–258. https://doi.org/10.29408/jel.v6i2.2134
16. Mahmud. (2011). Metode penelitian pendidikan. Pustaka Setia.
17. Mappasoro, S. (2012). Strategi pembelajaran. Badan Penerbit UNM.
18. Maulidiyah, E. N. (2020). Psikologi pembelajaran anak berkebutuhan khusus. Deepublish.
19. Mumpuniarti. (2023). Pembelajaran Diferensiasi dan Adaptif bagi Anak dengan Kebutuhan Khusus di Sekolah Inklusif. Yogyakarta: FIPP UNY.
20. Piaget, J. (1970). Genetic epistemology (E. Duckworth, Trans.). Columbia University Press.
21. Pratiwi, I. A., Ardianti, S. D., & Kuryanto, B. (2021). Pembelajaran berbasis konstruktivisme berbantuan media konkret terhadap keaktifan dan hasil belajar matematika. Jurnal Elemen, 7(1), 89–102. https://doi.org/10.29408/jel.v7i1.2654
22. Pujadi, A. (2021). Implikasi teori kognitif Piaget dalam pembelajaran matematika di sekolah dasar. Jurnal

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DOI: 10.21070/acopen.11.2026.14975

Elemen, 7(2), 312–325.
23. Qomariyah, S. (2023). Metodologi penelitian: Pengembangan instrumen dan analisis data penelitian pendidikan. CV Media Sains Indonesia.
24. Radjab, E., & Jam'an, A. (2023). Metodologi penelitian bisnis dan manajemen.
25. Rahmawati. (2021). Penerapan pendekatan kontekstual dalam pembelajaran matematika bagi siswa tunagrahita. Pustaka Akademika.
26. Rusman. (2012). Model-model pembelajaran: Mengembangkan profesionalisme guru (2nd ed.). Rajawali Pers.
27. Rusman. (2017). Belajar dan pembelajaran: Berorientasi standar proses pendidikan. Kencana.
28. Sanjaya, W. (2006). Strategi pembelajaran berorientasi standar proses pendidikan. Kencana Prenada Media Group.
29. Subroto, T. (2016). Penelitian tindakan kelas: Teori dan praktis. Remaja Rosdakarya.
30. Sugiyono. (2016). Metode penelitian kuantitatif, kualitatif, dan R&D. Alfabeta.
31. Susanti, R. (2022). Metodologi penelitian pendidikan. Penerbit Press.
32. Susilawati, S. (2020). Teori belajar dan praktik pembelajaran anak berkebutuhan khusus. Sanabil.
33. Trianto. (2008). Kurikulum berorientasi pencapaian kompetensi: Desain pembelajaran terpadu (Contextual Teaching and Learning/CTL). Prestasi Pustaka.
34. Trianto. (2011). Mendesain model pembelajaran inovatif-progresif: Konsep, landasan, dan implementasinya pada Kurikulum Tingkat Satuan Pendidikan (KTSP). Kencana Prenada Media Group.
35. Wahyudi, W., & Winanto, A. (2018). Pengaruh penggunaan media konkret terhadap pemahaman konsep matematis siswa. Jurnal Pendidikan Dasar, 9(2), 145–154. https://doi.org/10.17977/jpd.v9i2.11234
36. Wahyuni, S. (2019). Penerapan model Contextual Teaching and Learning (CTL) untuk meningkatkan hasil belajar matematika pada siswa tunagrahita ringan. Deepublish.
37. Wechsler, D. (2014). WISC-V: Technical and interpretive manual. NCS Pearson.
38. Witono, A., & Hadi, S. (2025). Strategi pembelajaran matematika di sekolah dasar. Erlangga.
39. Zulfah. (2021). Interaksi sosial dan kemampuan kognitif: Tantangan dalam pemrosesan informasi dan penalaran individu. Penerbit Buku Pendidikan.

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