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CONTEXTUAL TEACHING AND LEARNING WITH SHOPPING SIMULATION TO IMPROVE FIRST-GRADE STUDENTS' DATA GROUPING OUTCOMES

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Abstract

Data grouping is an abstract topic for first-grade students, and early mathematics learning benefits from concrete experience. This classroom action research examined how learning outcomes in data grouping changed when conventional teaching in Cycle I was followed by Contextual Teaching and Learning (CTL) with a shopping simulation in Cycle II. The study followed the Kemmis and McTaggart model with 27 first-grade students at SDN 05 Madiun Lor, with one meeting per cycle (12 and 19 May 2026). Data came from end-of-cycle learning outcome tests (12 items in Cycle I and 13 in Cycle II), observation of implementation in Cycle II, and a review of student worksheets, and were analyzed descriptively. The mean score rose from 67.37 to 80.00 (normalized gain 0.39, moderate), and classical mastery (KKM 70) rose from 41% to 67%. Because the Cycle II test had one more item, a sensitivity check showed that mastery on the common items ranged from 67% to 89%, depending on how students answered the added item. Implementation reached 92%, which is very good. With non-identical tests and no comparison group, the findings are read as descriptive evidence of improvement, not of effect. The study documents a concrete lesson design for first-grade data grouping and indicates that a further cycle is needed.

Keywords: Contextual Teaching and Learning; shopping simulation; learning outcomes; data grouping; elementary school

Abstrak

Pengelompokan data merupakan topik yang abstrak bagi siswa kelas satu, sementara pembelajaran matematika pada tahap awal akan lebih efektif jika didukung oleh pengalaman konkret. Penelitian tindakan kelas ini mengkaji perubahan hasil belajar dalam materi pengelompokan data, dengan membandingkan metode pengajaran konvensional pada Siklus I dan pendekatan Contextual Teaching and Learning (CTL) melalui simulasi berbelanja pada Siklus II. Penelitian ini mengikuti model Kemmis dan McTaggart dengan subjek 27 siswa kelas satu di SDN 05 Madiun Lor, yang dilaksanakan dalam satu pertemuan per siklus (12 dan 19 Mei 2026). Data dikumpulkan melalui tes hasil belajar di akhir setiap siklus (12 butir soal pada Siklus I dan 13 butir soal pada Siklus II), observasi pelaksanaan pembelajaran pada Siklus II, serta analisis lembar kerja siswa, kemudian dianalisis secara deskriptif. Skor rata-rata meningkat dari 67,37 menjadi 80,00 (normalized gain 0,39; kategori sedang), dan ketuntasan klasikal (dengan KKM 70) meningkat dari 41% menjadi 67%. Mengingat terdapat perbedaan jumlah butir soal antara Siklus I dan II, dilakukan pemeriksaan sensitivitas yang menunjukkan tingkat ketuntasan pada butir soal yang sama berkisar antara 67% hingga 89%, bergantung pada jawaban

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siswa terhadap butir soal tambahan tersebut. Tingkat keterlaksanaan pembelajaran mencapai 92%, yang tergolong sangat baik. Karena instrumen tes yang digunakan tidak identik dan tidak terdapat kelompok pembanding, temuan ini dipahami sebagai bukti deskriptif mengenai adanya peningkatan, bukan sebagai bukti kausalitas (efek). Studi ini mendokumentasikan rancangan pembelajaran konkret untuk materi pengelompokan data di kelas satu dan menunjukkan perlunya pelaksanaan siklus lanjutan.

Kata kunci: *Contextual Teaching and Learning*; simulasi berbelanja; hasil belajar; pengelompokan data; sekolah dasar

INTRODUCTION

Early mathematics learning lays the foundation for students' later mathematical development, and the way it is taught shapes whether students experience mathematics as something meaningful or as a set of abstract symbols to memorize. Clements et al. (2023) reviewed research on pedagogies for early mathematics and noted that most effective approaches share core characteristics, including attention to children's interests and engagement and work on content matched to children's level of thinking. Contemporary views of learning likewise stress active, student-centered learning connected to real-life contexts instead of rote mastery of concepts (Muhali, 2019). For first-grade students, who are only beginning formal schooling, this means that new mathematical ideas need to be introduced through experiences they can see, handle, and talk about. In practice, however, early mathematical concepts are often presented symbolically and abstractly, which can make them hard for young learners to grasp (Dethan et al., 2026). Sujarwo and Kurniawan (2020) reported that elementary students often develop misconceptions in arithmetic operations because they have not mastered basic concepts such as place value, and that these gaps affect mathematics learning outcomes more broadly. Data grouping is another topic where this concern applies. It asks students to look at a collection of objects, decide on a shared attribute, sort the objects accordingly, and then record the result in a list, table, or diagram. Lewis Presser et al. (2022) describe data collection and analysis as an application of mathematical knowledge such as counting, sorting, and classifying to real-world questions, and as a basis for flexible problem solving with data. Van de Walle et al. (2019) likewise describe effective mathematics teaching as teaching that builds on how children learn and uses hands-on, problem-based activities. The first-grade topic of grouping data by lists and tables therefore carries more weight than its small size suggests, because it is where students first meet the idea that information can be organized and read. If students do not understand this step, later work with tables and diagrams may rest on procedures without meaning. The Indonesian curriculum places the same emphasis on this step. In the Phase A learning outcomes for mathematics (Grades I and II), the Data Analysis and Probability element expects students to order, sort, group, compare, and present data from collections of objects using tally marks and pictographs with no more than four categories (Badan Standar dan Asesmen Pendidikan, 2025). Grouping therefore appears among the first steps in a progression that leads students from handling objects to organizing and presenting data. Recent research in statistics education supports this position. De Souza and Guimarães (2025) describe data classification as an essential skill for developing children's statistical thinking and note that organizing and interpreting information depends directly on it. Their study with 5- and 6-year-old children also shows what makes the skill difficult. Identifying the criterion behind a ready-made classification was the

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more demanding task compared with finding the classes from a criterion that was given, and some children used more than one criterion at once or named a group after one of its members instead of a shared property. The participants were children in early childhood education, the age group immediately before primary school, so these findings are relevant to first-grade students who are just beginning to formalize the same skills. Difficulties of a similar kind appear one step later, when first-grade students are asked to record and read grouped data. Minanurrohman et al. (2026) reported that first graders in a primary school in Semarang made errors in counting and interpreting symbols in picture diagrams, had trouble with terms such as most, fewest, and order, and found it hard to order data from the smallest to the largest. They recommended the use of visual media and concrete objects to help students overcome these difficulties.

The need to strengthen this skill was also evident in the research class. Preliminary qualitative observations in the first-grade class at SDN 05 Madiun Lor showed that some students still had difficulty with the basic steps of data grouping. They had difficulty determining the criterion by which objects or data should be grouped, grouping objects or data accurately, and presenting the result of the grouping systematically. These three difficulties correspond to the steps described above, namely deciding on a shared attribute, sorting accordingly, and recording the result, and they resemble the difficulties with grouping criteria and with recording data reported in the studies cited earlier (Minanurrohman et al., 2026). Because the difficulties appeared in the grouping process itself and not only in the final table or diagram, the students needed an opportunity to go through the process with objects they could handle: looking at a set of items, discussing why some belong together, sorting them, and only then putting the result on paper. This points to the need for a learning strategy and learning media that make the grouping process concrete and that begin from a context students already know.

Contextual Teaching and Learning (CTL) is an approach that links subject matter with the situations students encounter in daily life (Kusnirova et al., 2026). Kovačević and Barbir (2024) trace its theoretical foundations to constructivist learning theory, in which students build knowledge through active engagement and interaction, and they connect CTL with problem-based and project-based teaching and with active forms of classroom work. Their survey of primary school teachers, however, found that teachers apply CTL principles relatively rarely, which suggests that documented classroom examples remain useful. In elementary mathematics, the evidence for CTL is generally positive. Ayunopiasari et al. (2023) reported improved mathematics learning outcomes among elementary students after CTL was applied, and Mira (2024) reported that CTL implementation improved students' understanding of mathematical concepts. W. P. Lestari et al. (2023) examined CTL combined with a cooperative learning model and found it effective for mathematics learning outcomes, while Rasmini and Antara (2023) reported a positive impact of contextual learning based on project assessment on elementary students' mathematics achievement, analyzed by students' numerical ability. Classroom studies with concrete media point in the same direction. Srisedani et al. (2026) applied CTL assisted by concrete media in a two-cycle classroom action research study on addition and subtraction in second grade and reported improved learning outcomes, while Merteasih and Adnyana (2026) reported a significant improvement in second-grade fraction learning in a one-group pretest–posttest study with 20 students. Djuariah (2022) used game money as a display tool in a CTL classroom action research study on the equality of money value in third grade; the mean score rose from 56 before the action to 66 in the first cycle and 83 in the second cycle, and classical completeness rose from 23%

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to 52% and then 94%. CTL has also been examined in relation to mathematical literacy (Afni & Hartono, 2020), conceptual understanding (Yeni et al., 2019), problem solving and mathematical communication through a metacognitive-based contextual learning model in fifth grade (Ahdhianto et al., 2020) and statistics material (Pangemanan, 2020) A meta-analysis has also addressed the effect of CTL, together with realistic mathematics education, on mathematical communication (Putri et al., 2022), and CTL has likewise been discussed for primary school mathematics more generally (Selvianiresa & Prabawanto, 2017). A recent systematic review of 18 articles published between 2022 and 2026 concluded that CTL consistently improved elementary students' mathematics outcomes across topics such as fractions, plane figures, integers, and the volume of solid figures (Lisdiana et al., 2026). The same review reported that learning completeness improved in each cycle of the classroom action research studies it covered, and that experimental studies found significant differences between CTL classes and control classes. The reviewers explained these results by noting that CTL connects mathematics learning with students' real-life experiences, making learning more meaningful and encouraging active participation. Attention has also been directed to the use of contextual learning resources. Nurjannah et al. (2025) emphasized teaching materials developed from the students' surrounding environment, while Susilawati (2023) demonstrated the use of the Contextual Teaching and Learning (CTL) model supported by concrete objects from the surrounding environment to improve mathematics learning outcomes. These findings suggest that contextual learning can be strengthened when mathematical concepts are connected not only to students' everyday experiences but also to familiar and concrete learning resources available in their environment. In madrasah ibtidaiyah, CTL has been reported to raise learning mastery in Akidah Akhlak (Khoiriyah et al., 2018) and the same journal has discussed contextual learning that takes students outside the classroom (Setiyorini, 2018). Studies of CTL-based mathematics learning also report better student engagement (Mentari & Syarifuddin, 2020), better critical thinking and character (F. P. Lestari et al., 2021), and the development of contextual learning tools for elementary school and for local-context mathematics (Retnawati et al., 2020)(Ekowati et al., 2022). Taken together, these studies give CTL a solid footing in elementary mathematics. They also show where the evidence is thinner. Lisdiana et al. (2026) identified a lack of cross-subject studies, a lack of experimental designs with control groups, and limited technology integration as gaps in the CTL literature on elementary mathematics.

Developmental theory and research on early mathematics help explain why contextual and concrete experience suits first-grade students. In Piaget's theory, children of about six to seven years are moving toward the concrete operational stage, which spans roughly seven to eleven years. At this stage children begin to think logically but still depend on objects and concrete experience to understand abstract concepts (Juwantara, 2019) Classification by attribute, the core of data grouping, is the kind of abstract operation that benefits from handling real objects. Research on concrete materials in first grade supports this reasoning. Dethan et al. (2026) conducted a one-group pretest–posttest study with 33 first-grade students and found that mean scores on addition and subtraction rose from 54.57 to 85.30 after instruction with concrete manipulatives, with a statistically significant difference. The authors explained this result by noting that concrete media turn abstract symbols into representations that students can observe and manipulate. Early data learning shows a similar pattern. Lewis Presser et al. (2022) piloted hands-on data collection and analysis investigations in preschool classrooms, in which children counted,

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sorted, classified, and compared objects, pictures, and even their own bodies before working with graphs. Teachers rated the activities as developmentally appropriate overall, and children's scores on a data and mathematics assessment rose from the pre-intervention to the post-intervention measurement. The same study cautions that young children need scaffolding at each stage of working with data, and it had no comparison group. Clements and Sarama (2021) describe learning trajectories as a way to help teachers understand children's level of mathematical understanding, and Clements et al. (2021) add that effective early mathematics approaches work on content matched to children's level of thinking. The concrete–representational–abstract (CRA) sequence formalizes this progression from objects to pictures to symbols and has been reviewed as an evidence-based approach, although most of that evidence comes from students with learning difficulties and from single-case studies (Bouck et al., 2018) (Ebner et al., 2025)). For first-grade students, a data grouping lesson should therefore begin with real objects, move to talk about what the objects have in common, and only then arrive at lists, tables, and diagrams as ways of recording the grouping. CTL offers a way to organize such a lesson, because it starts from a context that students already know.

Simulations of everyday transactions are a natural way to bring context into early mathematics. In a shopping simulation, students take the roles of buyers and sellers, handle goods, and work with lists and quantities, so that mathematical ideas appear inside an activity they recognize. This context also suits data grouping in a natural way: goods in a market already fall into categories such as fruit, snacks, or stationery, and a shopping list asks students to find, count, and sort items by category, so the groups students build mirror categories they already use in daily life. A worksheet that gives a table without such a context asks students to accept the categories as given; a simulation lets them see why the categories exist. Mardliyah et al. (2026) examined a deep learning approach built on a simulated buying-and-selling activity with traditional market snacks in a first-grade class in Semarang, taught on the topic of money value. Their qualitative analysis, which used triangulation of sources and techniques, reported greater active engagement, better understanding of money value, and a better ability to apply knowledge in simple transaction situations. They also described the learning as mindful, meaningful, and joyful. This study is the closest to the present one in grade level and learning context. It differs in topic (money value rather than data grouping), in theoretical framing (deep learning rather than CTL), and in design (a qualitative analysis that does not report learning outcome scores). Research on early data learning, for its part, concentrates on preschool settings and on investigations using hands-on materials and digital tools (Lewis Presser et al., 2022), rather than on simple transaction contexts in the early primary grades. Studies of CTL in elementary mathematics have examined the approach across various mathematical topics. The systematic review by Lisdiana et al. (2026), which analyzed 18 studies published between 2022 and 2026, identified CTL applications in topics including fractions, plane figures, integers, and the volume of solid figures; data grouping was not among the topics explicitly identified in their synthesis. These findings suggest a specific area that warrants further investigation. Recent studies also show that contextual mathematics learning can incorporate authentic shopping simulations and concrete materials while examining students' learning outcomes and classroom implementation. For example, Kamaria and Rachmawati (2026) used a Mini School Store simulation, play money, and concrete materials within CTL instruction, but their study focused on fifth-grade students' understanding of place value and number comparison rather than data grouping. Similarly, a 2025 study examined CTL among first-grade

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students, but focused on addition and subtraction rather than data grouping. Therefore, the combination of CTL, a shopping simulation, data grouping, and first-grade mathematics learners remains insufficiently represented in the recent literature identified here. The present study addresses this area by examining both students' learning outcomes and the quality of lesson implementation.

The present study responds to this gap by applying CTL through shopping simulation to the teaching of data grouping in a first-grade class. Therefore, this study intends to describe how CTL through shopping simulation was implemented in a first-grade class and to examine how first-grade students' learning outcomes in data grouping changed after the shift from conventional learning in Cycle I to CTL through shopping simulation in Cycle II. The objectives of this study are (1) to describe the implementation of learning with CTL through shopping simulation in Cycle II, and (2) to describe the change in students' mean score and classical mastery in data grouping from Cycle I to Cycle II. Its contribution lies in the combination of approach, activity, topic, and grade level. CTL supplies the pedagogical frame, in which constructivism, modeling, and authentic assessment guide the lesson design. The shopping simulation supplies a familiar context and concrete objects. Data grouping supplies a foundational topic of early data learning, and first-grade students represent a developmental stage at which concrete experience is especially important. The study does not claim to be the first to use CTL, a transaction simulation, or concrete media in mathematics, since each of these has been studied separately, as reviewed above. Instead, it adds learning outcome data and implementation data from a classroom action research design, which complements the qualitative evidence of Mardliyah et al. (2026) and the experimental evidence summarized by Lisdiana et al. (2026). The study follows the Classroom Action Research model of Kemmis and McTaggart (Kemmis et al., 2014) in which the teacher plans, acts, observes, and reflects in successive cycles, and this article reports two cycles, Cycle I with conventional learning and Cycle II with CTL through shopping simulation. This cycle-based design has also been used in madrasah ibtidaiyah classrooms (Khoiriyah et al., 2018) (Ulfa et al., 2023) For practice, the study documents a lesson design that other first-grade teachers can adapt, together with evidence on how it worked in one classroom. For research, it adds a case in which each CTL component is tied to a concrete topic and a concrete activity, which makes the design easier to examine and to replicate in later studies. What the study can show is whether implementation and learning outcomes improved after the CTL action in Cycle II compared with Cycle I in this class; it cannot show that CTL caused the gains or that it outperforms other approaches. The study is also relevant to Islamic primary education (madrasah ibtidaiyah), where mathematics learning can be connected to students' everyday experiences and familiar social contexts. The shopping simulation provides a contextual setting for developing early mathematical understanding while also encouraging values such as honesty, responsibility, cooperation, and respectful interaction that are consistent with the educational aims of madrasah ibtidaiyah.

METHOD

Research Design

This study used Classroom Action Research (CAR), in which the teacher investigates and improves learning in his or her own classroom. It followed the Kemmis and McTaggart model of planning, acting, observing, and reflecting in successive cycles (Kemmis et al., 2014), a design that has also been used in madrasah ibtidaiyah classrooms

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(Khoiriyah et al., 2018) (Ulfa et al., 2023). The study was carried out in two cycles with one meeting each (Table 1). In Cycle I, students were taught through conventional learning, and the reflection on its results showed that classical mastery had not reached the success criterion. In Cycle II, the researcher therefore applied CTL through shopping simulation to improve students' learning outcomes in data grouping. Two success criteria were set: at least 75% of students reaching the minimum mastery criterion (KKM) of 70 in the learning outcome test, and learning implementation of at least 80%. Cycle I served as the baseline and as the first reflection point, so Cycle II is the first cycle in which the action was implemented and observed. Because each cycle consisted of a single meeting, the study is best read as a short-cycle study rather than a full multi-meeting CAR project.

Table 1. Overview of the Classroom Action Research Cycles

Stage	Description
Cycle I – Planning	The topic "Getting to Know Diagrams: Grouping Data Based on Lists and Tables" was taken as the learning content, with a KKM of 70 and a classical mastery criterion of 75%.
Cycle I – Acting	Conventional learning on 12 May 2026: the teacher explained the material by lecture and students worked on ordinary exercises without learning media (one meeting).
Cycle I – Observing	A 12-item learning outcome test was given at the end of the meeting. Implementation was not observed.
Cycle I – Reflecting	Test results were analyzed: mean score 67.37 and 40.74% of students at or above the KKM, below the 75% criterion. Decision: plan an action that gives students concrete experiences in grouping data.
Cycle II – Planning	A lesson plan (RPM) was prepared for the same topic, using Problem Based Learning syntax with CTL through shopping simulation as the approach, together with the mini-market medium, shopping lists, A3 group worksheets, apperception media, a 13-item test, and observation sheets.
Cycle II – Acting	CTL lesson with shopping simulation on 19 May 2026 (2 × 35 minutes, one meeting), as set out in Table 2.
Cycle II – Observing	The cooperating teacher observed implementation (17 teacher and 8 student indicators); the 13-item test was given at the end of the lesson; group worksheets were reviewed.
Cycle II – Reflecting	Test, implementation, and worksheet data were analyzed: mean score 80.00 and 66.67% at or above the KKM, below the 75% criterion. Decision: continue and refine the action in a further cycle, with differentiated teaching for students below the KKM.

Source: Authors' compilation from the lesson plan (RPM) and the cycle records, 2026.

Participants

The participants were 27 first-grade students at SDN 05 Madiun Lor during the even semester of the 2025/2026 academic year. The study was conducted in two cycles:

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Cycle I on 12 May 2026 and Cycle II on 19 May 2026, with one meeting in each cycle. The cooperating teacher (*guru pamong*) observed the learning activities during Cycle II.

Ethical Considerations and Research Permission

The lesson was a regular lesson on a topic in the Phase A mathematics curriculum (Chapter 8, "Getting to Know Diagrams") and was taught by the first author during teaching practice (PPL) in the Pendidikan Profesi Guru (PPG) program, in the class of the cooperating teacher (third author) and under the supervision of the field supervisor (second author). The school was the first author's PPL placement, and the study was carried out within that placement. The school principal, the cooperating teacher, and the classroom teacher gave oral permission for the lesson and for the use of the learning data, and the classroom teacher gave it on behalf of the students; no written permission letter was issued. The article was written to meet a graduation requirement of the PPG program, and no ethical review procedure was available for this requirement, so no formal ethical clearance was obtained. No separate informed consent was collected from parents or guardians, because the lesson was a regular classroom lesson. To protect students' privacy, individual results are reported with codes (S01–S27) instead of names, and no photographs or other identifiable documentation are included. In line with the lesson plan, students who had not reached the KKM were to receive remedial teaching adjusted to their needs.

Procedures

In Cycle I, the lesson on the Mathematics topic "Getting to Know Diagrams: Grouping Data Based on Lists and Tables" was delivered through conventional learning, in which the teacher explained the material by lecture and students worked on ordinary exercises without learning media. At the end of the meeting, students completed a learning outcome test. In the reflecting stage, the test results were analyzed, and because classical mastery did not reach the 75% success criterion, the researcher planned an action for Cycle II that would give students concrete experiences in grouping data.

In the planning stage of Cycle II, the researcher prepared a Deep Learning Lesson Plan (*Rencana Pembelajaran Mendalam*, RPM) for the same topic, a mini-market medium for the shopping simulation, shopping lists, A3 group worksheets, an apperception video, the learning outcome test, and observation sheets. The lesson lasted two lesson hours of 35 minutes each. In the acting stage, learning was delivered through Contextual Teaching and Learning (CTL) using a shopping simulation and emphasizing three CTL components: constructivism, modeling, and authentic assessment (Table 2). For constructivism, students observed and discussed the mini-market, where goods were arranged by type, enabling them to construct the concept of grouping rather than receiving the concept directly from the teacher. For modeling, students worked in groups, received shopping lists and worksheets, took turns "shopping" according to the lists, and then counted, grouped, and presented the items they obtained in tables or pictorial diagrams. For authentic assessment, each group presented its table and diagram to the class and answered questions about the data, such as which item was the most numerous, which was the least numerous, and the difference in quantity between items. In the observing stage, the cooperating teacher used CAR observation sheets to assess the implementation of the learning activities, using 17 indicators of teacher activity and 8 indicators of student activity, each rated on a four-point scale. In the reflecting stage, the observation and test results were analyzed to identify areas for improvement in the subsequent cycle.

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The reflection in each cycle followed the same steps: (a) scoring the test with the formula given under Instruments; (b) calculating the mean score and the proportion of students reaching the KKM and comparing it with the 75% criterion; (c) in Cycle II, reading the implementation score and reviewing students' worksheets to see where students below the KKM had difficulty; and (d) deciding on the follow-up. The decision after Cycle I was to introduce concrete experience through CTL with shopping simulation. The decision after Cycle II was to continue and refine the action in a further cycle, with differentiated remedial teaching for students below the KKM, as set out in the remedial section of the lesson plan, and a home task of grouping at least five household objects. The reflection took the form of a discussion between the researcher and the cooperating teacher after each lesson. After Cycle I, which used conventional learning without CTL, the cooperating teacher gave feedback on the lesson, and this feedback was considered together with the test results in planning Cycle II. After Cycle II, the cooperating teacher also handed over the completed observation sheet and gave feedback, and the researcher used it to decide what to improve in the next cycle.

Table 2. Stages of the Cycle II Lesson

Stage	Student and teacher activities
Opening	Greetings, prayer, attendance, class agreements, and a simple ice-breaking song; students observe pictures of messy and tidy arrangements and answer apperception questions; the teacher states the learning objectives and links them to daily life.
Orienting students to the problem	Students observe the mini-market in which goods are arranged by type; the teacher asks why goods in a market are arranged and grouped by type; students give opinions; the teacher reinforces how data are grouped in tables and picture diagrams.
Organizing students	Students are placed in groups according to attendance numbers; each group receives a shopping list and an A3 worksheet; the teacher explains the rules of the shopping simulation.
Guided investigation	Students take turns shopping according to their list, count each type of goods, group the goods by type, paste the result into a table or diagram on the A3 sheet, and answer questions below it (most bought, least bought, total, and difference); the teacher guides groups that have difficulty.
Presenting the work	Group representatives present the results on the A3 sheet and answer the teacher's questions; the teacher reinforces students' work and answers.
Reflection and closing	Students and the teacher reflect on what was learned and which part was most enjoyable; students complete the learning outcome test and conclude the lesson; the teacher assigns a home task of grouping at least five household objects; the lesson closes with a prayer.

Source: Authors' lesson plan (RPM) for Cycle II, 2026.

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Instruments

Data were collected through learning outcome tests administered at the end of each cycle, namely after the conventional lesson in Cycle I (12 May 2026) and after the CTL lesson with shopping simulation in Cycle II (19 May 2026), and through observation sheets of teacher and student activities in Cycle II. The tests used student worksheets and consisted of four main tasks covering the same learning objectives and indicators, namely identifying, organizing, and presenting data in tables and picture diagrams (Table 3). The tasks included determining the number of students for each fruit from picture data, constructing picture diagrams, completing a table based on a short story, and determining the most and fewest bought items and the difference between two items. The Cycle I test consisted of 12 items, and the Cycle II test consisted of 13 items because one question was added to Task 4, asking students to reason from the data about how many students bought stationery if two students bought books. The two tests also differed in Task 3: in Cycle I students wrote the names of the items in the table themselves, whereas in Cycle II the item names were provided. The two tests therefore used comparable tasks with the same learning objectives and indicators, but they were not identical. Each test item was scored with 1 point when answered correctly. For example, Task 1 consisted of three items, with each item awarded 1 point. The students' final scores were calculated using the formula: score obtained divided by the maximum score (12 in Cycle I and 13 in Cycle II) multiplied by 100, rounded down to a whole number. The mean score of the Cycle I test was 67.37, which served as the baseline for the Cycle II action.

Table 3. Blueprint of the Learning Outcome Tests

Task	Indicator	Item numbers	Cognitive level
1	Determining the number of students who like apples, bananas, and grapes from picture data	1–3	C1
2	Constructing picture diagrams of apples, bananas, and grapes according to the data	4–6	C2
3	Completing a table with the number of buyers of pencils, erasers, and books from a short story	7–9	C2
4	Determining the most bought item, the least bought item, and the difference between pencils and books; Cycle II adds one reasoning question	10–12 (Cycle I); 10–13 (Cycle II)	C3

Source: Learning outcome tests used in Cycle I and Cycle II, 2026.

Comparability of the two tests. The two tests were built from the same blueprint and covered the same learning objectives and the same four tasks (Table 3), but they were not identical in length or format: the Cycle II test had one more item (13 versus 12), and item names were provided in Task 3. The scores are therefore not on an equated scale, and the change in the mean score and in mastery between cycles is treated as indicative. To show how much this matters, Cycle II mastery was recalculated under two limiting assumptions about the added item (Table 7).

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Data Analysis

Test data were analyzed by calculating the mean score and the percentage of students who reached the minimum mastery criterion (KKM) of 70. Classical mastery was considered achieved when at least 75% of students reached the KKM. The results of Cycle II were compared descriptively with those of Cycle I, both for the class as a whole and for each student. The size of the improvement in the class mean was also expressed as the normalized gain (Hake, 1998), calculated as (post-test mean − pre-test mean) / (100 − pre-test mean) and interpreted as low (below 0.3), moderate (0.3 to 0.7), or high (0.7 and above). Observation data were analyzed descriptively and quantitatively as percentages and interpreted using the categories in Table 4. Learning implementation of at least 80% was considered successful, and below 80% was considered not yet successful. Because the two tests differed by one item, Cycle II mastery was also recalculated under the two limiting assumptions for the added item (Table 7).

Table 4. Categories of Learning Implementation

Percentage interval	Category
≥86%	Very good
≥76% to <86%	Good
≥60% to <76%	Fair
≥55% to <60%	Poor
<55%	Very poor

Source: Developed by the authors based on the lesson plan (RPM) designed for this study.

RESULTS AND DISCUSSION

Results

Learning implementation was observed in Cycle II, in which CTL with shopping simulation was applied (Table 5). Teacher and student activities obtained scores of 64 out of 68 and 28 out of 32, which correspond to 94.12% and 87.50%, respectively. The total score was 92 out of 100, resulting in an implementation rate of 92%, which was categorized as very good and exceeded the predetermined success criterion of 80%. Implementation was not observed in Cycle I, so no comparison of implementation between the two cycles is reported.

Table 5. Implementation of the Cycle II Lesson

Aspect	Score obtained	Maximum score	Percentage
Teacher activity (17 indicators)	64	68	94.12
Student activity (8 indicators)	28	32	87.50
Total	92	100	92.00 (very good)

Source: Observation sheets completed by the cooperating teacher, Cycle II, 2026.

Learning outcomes were measured with a test at the end of each cycle (Table 6). After Cycle I, which used conventional learning, the class mean score was 67.37. After Cycle II, which used CTL with shopping simulation, the mean score rose to 80.00, an

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increase of 12.63 points. The number of students reaching the KKM of 70 rose from 11 of 27 (40.74%) to 18 of 27 (66.67%), and the number of students who had not reached the KKM fell from 16 to 9. The normalized gain of the class mean was 0.39 ((80.00 − 67.37) / (100 − 67.37)), which falls in the moderate category. Because the two tests are not equated (Table 3), this gain is descriptive.

Table 6. Learning Outcome Results of Cycle I and Cycle II

Aspect	Cycle I	Cycle II	Change
Number of students	27	27	–
Mean score	67.37	80.00	+12.63
Students reaching KKM (≥70)	11	18	+7
Classical mastery (%)	40.74	66.67	+25.93 percentage points
Students not reaching KKM	16	9	−7

Source: Learning outcome tests, Cycle I and Cycle II, 2026.

Because the Cycle II test had one more item than the Cycle I test, Cycle II mastery was checked against the two limiting cases for the added item (Table 7). Eighteen students had at least 10 of 13 items correct; even if the added item was one they answered incorrectly, they would still have at least 10 of the 12 common items (83%) and would reach the KKM. Six students had 9 of 13 correct (69.2%), just below the KKM. If they answered the added item incorrectly, all 9 correct answers fall within the 12 common items (75%) and they reach the KKM; if they answered it correctly, they have 8 of 12 (66.7%) and do not. The three students with 6 of 13 correct do not reach the KKM in either case. Cycle II mastery on the common items therefore lies between 66.67% (18 of 27 students) and 88.89% (24 of 27 students). Item-level data are not available, so the position within this range cannot be determined.

Table 7. Sensitivity of Cycle II Classical Mastery to the Added Test Item

Scenario	Students reaching KKM	Classical mastery	Meets 75% criterion
As scored on 13 items	18 of 27	66.67%	No
Case A: the six students with 9 correct answers answered the added item correctly (8 of 12 common items)	18 of 27	66.67%	No
Case B: the six students with 9 correct answers answered the added item incorrectly (9 of 12 common items)	24 of 27	88.89%	Yes

Source: Authors' calculation from individual Cycle II scores (Table 9), 2026.

The distribution of scores also shifted between the two cycles (Table 8). The number of students scoring 85 or higher rose from 7 to 10, and the number scoring between 50 and 69 fell from 13 to 6. The number of students scoring below 50 remained at 3, although the students in this range were not the same in the two cycles.

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Table 8. Distribution of Student Scores by Score Range

Score range	Cycle I	Cycle II
Below 50	3	3
50–69	13	6
70–84	4	8
85–100	7	10

Source: Learning outcome tests, Cycle I and Cycle II, 2026.

At the individual level (Table 9), 17 students scored higher in Cycle II than in Cycle I, with an average gain of 28.2 points among them, one student had the same score, and 9 students scored lower. Ten students who had not reached the KKM in Cycle I reached it in Cycle II, whereas three students who had reached the KKM in Cycle I scored below it in Cycle II, two of them at 46. Because the two tests were comparable but not identical, these individual differences cannot be attributed to a single cause. They do show that students' needs varied and that follow-up support needs to be adjusted to individual students. Six students (S02, S08, S09, S11, S25, and S26) obtained a score of 69 in Cycle II, one point below the KKM because 9 of 13 correct answers equal 69.2%, whereas one more correct answer (10 of 13) would have given 76.

Table 9. Individual Scores in Cycle I and Cycle II

Student	Cycle I	Cycle II	Change	KKM reached in Cycle II
S01	50	84	+34	Yes
S02	25	69	+44	No
S03	83	84	+1	Yes
S04	100	92	−8	Yes
S05	100	100	0	Yes
S06	91	84	−7	Yes
S07	100	92	−8	Yes
S08	58	69	+11	No
S09	50	69	+19	No
S10	58	92	+34	Yes
S11	83	69	−14	No
S12	50	46	−4	No
S13	66	92	+26	Yes
S14	91	84	−7	Yes
S15	100	46	−54	No
S16	66	92	+26	Yes
S17	75	92	+17	Yes
S18	66	92	+26	Yes
S19	50	84	+34	Yes
S20	50	84	+34	Yes

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Student	Cycle I	Cycle II	Change	KKM reached in Cycle II
S21	75	46	−29	No
S22	66	100	+34	Yes
S23	100	92	−8	Yes
S24	50	84	+34	Yes
S25	50	69	+19	No
S26	25	69	+44	No
S27	41	84	+43	Yes

Source: Learning outcome tests, Cycle I and Cycle II, 2026.

Students' worksheets in Cycle II showed where the remaining difficulties lay. According to the researcher's review of the worksheets, students who had not reached the KKM mainly had difficulty answering Part B, the story problems labeled as simple higher-order thinking (HOTS) questions, which ask students to interpret the data and compare quantities and not only to record them. A sample worksheet from a student who had not reached the KKM illustrates this pattern. The student completed the table of fruit data in Task 1 and drew the picture diagram in Task 2 correctly, but made errors in the story-based table in Task 3 and in the questions in Task 4 that asked for the difference between two quantities and for a conclusion drawn from the data.

Discussion

An implementation rate of 92% in Cycle II shows that the CTL lesson with shopping simulation could be carried out as planned. The observation data suggest that the teacher followed the lesson stages consistently and that students were actively involved in the shopping simulation, group discussion, construction of tables and diagrams, and presentation of results. This is likely related to the preparation done in the planning stage, when the lesson plan, mini-market medium, worksheets, and shopping lists were ready before the action. The result is worth noting because Kovačević and Barbir (2024) found that primary school teachers apply CTL principles relatively rarely; here, with prepared materials, a CTL lesson could be implemented at a very good level. Kusnirova et al. (2026) likewise noted considerable variability in how CTL is conceptualized and applied across studies, which is why Table 2 specifies the CTL components used and how each was enacted in the lesson. Because implementation was measured through observation sheets, however, the data cannot show which component of the preparation contributed most. Implementation was also not observed in Cycle I, so the study cannot compare implementation between the conventional lesson and the CTL lesson.

What this study found is that the mean score and the number of students reaching the KKM both increased from Cycle I to Cycle II, when the conventional lesson was replaced by CTL with shopping simulation. The normalized gain of 0.39 indicates a moderate improvement in the class mean (Hake, 1998), although it is descriptive because the tests are not equated. A plausible explanation lies in the developmental characteristics of first-grade students. Students at this age are moving toward the concrete operational stage and still rely on objects and concrete experience to understand abstract concepts (Juwantara, 2019). In Cycle I, the material was delivered through lecture and ordinary exercises without media, so students met grouping mainly as an explanation and a written

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task. Data grouping is abstract because it requires classifying by attributes and representing the result in a table or diagram. The shopping simulation made this process concrete: students could see, hold, count, and group real goods themselves, so classification was built from hands-on experience and not learned only as a symbolic procedure. This reading agrees with Dethan et al. (2026), who explained gains among first-grade students by the way concrete media turn abstract symbols into representations that can be observed and manipulated, and with Clements and Sarama (2021), who highlight content matched to children's level of thinking. Lewis Presser et al. (2022) add that counting, sorting, and classifying objects are the mathematical base of early data work. The present design cannot test this mechanism directly, so it remains a plausible explanation rather than a demonstrated one. The sequence of the lesson, from real goods to a table or picture diagram on the A3 sheet, also follows the concrete–representational–abstract sequence reviewed by Bouck et al. (2018) and Ebner et al. (2025) because that evidence comes mostly from students with learning difficulties and single-case studies, its transfer to a regular first-grade class is an assumption here.

Four features of the lesson plausibly explain why the shopping simulation supported data grouping. Each is tied to a step of the lesson plan (Table 2), and none was tested directly. First, the categories had a purpose. In the orientation phase students were asked why goods in a market are arranged by type, so grouping was presented as a way of finding and counting things before it was presented as a table. This fits the CTL idea that new concepts are built from situations students already know (Kusnirova et al., 2026); (Kovačević & Barbir, 2024) and reports that contextual mathematics learning can raise engagement (Mentari & Syarifuddin, 2020) Second, the shopping list turned grouping into a sequence of actions students could carry out: find an item, take it, count it, and place it with items of the same kind. Handling the goods made the shared attribute visible, which addresses the difficulty young children have in identifying the criterion behind a classification (de Souza & Guimarães, 2025). Third, the A3 sheet served as the step between objects and symbols. Students placed the goods they had gathered into a table or diagram and only then answered questions about the most, the least, the total, and the difference, which follows the order of concrete, representational, and abstract work (Bouck et al., 2018) (Ebner et al., 2025). Fourth, group work and presentation required students to state in words what they had done, so each group had to say its grouping criterion and its comparison aloud. This gave the teacher a view of students' reasoning during the lesson, and the presentation served as the authentic assessment component. Yu et al. (2021) examined the effect of educational games on learning outcomes, motivation, engagement, and satisfaction, which is consistent with, but does not demonstrate, a role for engagement here.

These mechanisms also show where the lesson was weaker. The shopping task practiced counting, grouping, and recording, but the questions that most students below the KKM missed were the story problems that asked them to interpret grouped data and compare quantities. The simulation addressed these only through the questions under the A3 sheet and the group presentation, which suggests that the step from handling objects to reasoning about data in words was not yet sufficiently supported. The mechanisms above are interpretations drawn from the lesson design and the worksheet review; the study had no measure of engagement, no item-level data, and no comparison condition, so they cannot be confirmed here.

What previous studies found can be summarized as follows. Elementary CTL studies reported better mathematics outcomes (Ayunopiasari et al., 2023) (Mira, 2024),

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including when CTL was combined with cooperative learning (Lestari et al., 2023) or project-based assessment (Rasmini & Antara, 2023). Classroom studies of CTL with concrete media in second and third grade (Djuariah, 2022); (Merteasih & Adnyana, 2026); (Srisedani et al., 2026) also reported improved learning outcomes, and the use of game money as a display tool in Djuariah (2022) resembles the use of a mini-market here. A systematic review reported that learning completeness improved in each cycle of classroom action research studies and that experimental studies found significant differences from control classes (Lisdiana et al., 2026). Concrete manipulatives were associated with higher early numeracy scores among first-grade students (Dethan et al., 2026), and a first-grade shopping-type simulation was associated with more active engagement and better understanding of money value (Mardliyah et al., 2026). The direction of the present findings is consistent with all of these studies. The emphasis on concrete objects and surrounding-environment resources in Nurjannah et al. (2025) and Susilawati (2023) also resembles the use of a mini-market here. Because the studies differ in topic, design, and measures, the numerical results cannot be compared directly, and because this study has no control group, its findings should be read as consistent with earlier work rather than as confirming it. Two studies in Al-Mudarris report similar patterns in madrasah ibtidaiyah classrooms, although in other subjects: CTL raised mastery in a Grade V Akidah Akhlak class from 65.22% in Cycle I to 86.95% in Cycle II (Khoiriyah et al., 2018), and a snakes-and-ladders game medium raised science mastery in a Grade IV class from 9.1% before the action to 81.82% after two cycles (Ulfa et al., 2023).

The contribution of this study lies in applying contextual teaching and learning (CTL) through an everyday shopping simulation to data grouping in a first-grade classroom, with both learning outcome and implementation data used to evaluate the intervention. This study differs from Mardliyah et al. (2026), who used a shopping transaction simulation with first-grade students to support learning about money values through a deep-learning approach. The present study uses a similar everyday transaction context but applies it within a CTL framework to data grouping, tables, and picture diagrams. This focus also complements the recent systematic review by Lisdiana et al. (2026), which reported the use of CTL across various elementary mathematics topics, including fractions, plane figures, integers, and solid-figure volume. Thus, the contribution of the present study is not the use of CTL or shopping simulation alone, but their application to early data learning through a familiar transaction context in first-grade mathematics.

The comparison between cycles rests on two tests that shared a blueprint but differed in length and in one task format (Table 3). Three consequences follow. First, percentage scores from a 12-item test and a 13-item test are not on an equated scale, so the 12.63-point increase in the mean score should be read as indicative. Second, the extra item and the provision of item names in Task 3 could have made the Cycle II test easier or harder, and the direction cannot be determined without item-level data. Third, the limiting cases in Table 7 show that the KKM classification of six students depended on a single item. Future cycles should use one identical or formally equated test, with items matched to indicators and scored item by item, so that a change in a student's score can be linked to a specific indicator.

Classical mastery of 66.67% after Cycle II is higher than in Cycle I (40.74%) but below the 75% criterion, so on the study's own criterion for learning outcomes the action cannot yet be called successful. Three points qualify this reading without reversing it.

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First, the shortfall is small in absolute terms: 21 of 27 students would have been needed (75% of 27 is 20.25), and 18 reached the KKM. Six of the nine students below the KKM scored 69, one correct answer short, and the sensitivity check (Table 7) shows that Cycle II mastery on the common items could be anywhere from 66.67% to 88.89%, a range that includes the criterion. Because item-level data are not available, the result is better described as undetermined than as clearly failing or clearly meeting 75%. Second, the gains were uneven. The 17 students who improved gained 28.2 points on average and ten students moved from below to above the KKM, but nine students scored lower, three students who had reached the KKM in Cycle I (S11, S15, and S21) fell below it, and three students scored 46 (6 of 13 items). High Cycle I scores that fell in Cycle II, such as S15 (100 to 46), may reflect differences between the tests, attention on the test day, or regression toward the mean, and this design cannot separate these from the effect of the lesson. Third, the 75% criterion rests on one cognitive test taken on one day, and this study did not assess attitude or skills, so the findings speak only to learning outcomes and to the quality of implementation. The defensible reading is that the lesson was implemented well, that learning outcomes improved descriptively, and that the success criterion for classical mastery was not clearly reached, which is why a further cycle is needed. This is consistent with the iterative logic of CAR (Kemmis et al., 2014) (Lisdiana et al., 2026), but it is not a reason to treat the result as a success.

The scores were not analyzed item by item, so the reasons why the remaining students did not reach the KKM cannot be determined precisely. However, the review of students' worksheets showed that these students mainly had difficulty with the story problems labeled as simple HOTS questions, which require students to interpret grouped data and compare quantities and not only to record them. This difficulty relates to mathematical communication, a skill that has been examined in contextual learning research (Ahdhianto et al., 2020); (Putri et al., 2022) and it suggests that the next cycle should give explicit practice in reading and discussing data in words. Classroom observations also indicated that some students still needed guidance when transferring the grouped objects from the shopping simulation into tables and diagrams, which is in line with Lewis Presser et al. (2022), who found that young children benefit from scaffolding at different stages of working with data. In line with the lesson plan, students who had not reached the KKM are to receive differentiated remedial teaching, and the follow-up actions for the next cycle are more intensive guidance during data organization, a wider variety of shopping items, and repeated practice in constructing tables and diagrams and in answering simple story problems that ask students to compare quantities.

For elementary mathematics teaching, the findings suggest that abstract topics in the early grades can be introduced through familiar activities in which students work with concrete objects before moving to tables and diagrams. Group work followed by presentation can also give teachers evidence of students' understanding beyond test scores. Several limitations should be noted. The study reports two cycles of one meeting each in one class of 27 students and has no comparison group. The cycles were held a week apart (12 and 19 May 2026), so maturation, familiarity with the test format, and the different test content are alternative explanations for the gains, and the lack of a control condition limits causal claims (Knapp, 2016), a gap also identified in the wider CTL literature (Lisdiana et al., 2026). The two tests were comparable but not identical and not equated (Table 3 and Table 7). The lesson plan named Problem Based Learning as the learning model, with CTL through shopping simulation as the approach used within it, so the effect of CTL cannot be separated from the PBL syntax that organized the lesson. No

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statistical test was conducted, so the improvements are descriptive. The researcher taught the lesson and reviewed the worksheets, which may introduce bias, and implementation was observed by one observer in Cycle II only and is reported as aggregate scores. The study focused on cognitive learning outcomes and lesson implementation; attitude and skills were not assessed for this article. Further cycles are needed to determine whether the success criterion can be achieved and sustained. Future studies could add a comparison group, use equated tests with item-level analysis, report scored attitude and skill rubrics alongside the cognitive test, and examine the approach across topics and grade levels.

CONCLUSION

This study examined how first-grade students' learning outcomes in data grouping and the implementation of the lesson changed when conventional learning in Cycle I was followed by CTL with shopping simulation in Cycle II. The mean score rose from 67.37 to 80.00 and classical mastery rose from 40.74% to 66.67%, which is below the 75% success criterion. Because the Cycle II test had one more item than the Cycle I test, mastery on the common items could lie between 66.67% and 88.89%, so it cannot be said whether the criterion was reached. The lesson was implemented at 92%, in the very good category. These results describe an improvement in one class under a design without a comparison group and with tests that were not equated, so they do not show that CTL or the shopping simulation caused the change, and the study did not assess attitude or skills. The most defensible conclusion is that the shopping simulation is a feasible, concrete lesson design for data grouping in first grade and is worth testing further. A further cycle with one equated test, item-level analysis, scored attitude and skill rubrics, stronger support for story problems that ask students to interpret data, and, if possible, a comparison group is needed before firm conclusions are drawn. Teachers who adapt the lesson are advised to combine the simulation with guided practice in reading data in words.

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