

THE IMPLEMENTATION OF CONTEXTUAL TEACHING AND LEARNING (CTL) USING VISUAL MEDIA TO IMPROVE THIRD-GRADE STUDENTS' MATHEMATICS LEARNING OUTCOMES AT SD GMIM 1 WOLOAN

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ARTICLE HISTORY

Received : 15-08-2026

Revised : 23-09-2026

Accepted : 30-09-2026

KEYWORDS

Contextual Teaching and Learning, visual media, mathematics learning outcomes, data presentation, primary school.

ABSTRACT

Mathematics instruction on data presentation in tables at the primary school level requires contextual learning experiences and visual representations to facilitate students' understanding of mathematical information. This study aimed to improve mathematics learning outcomes through the implementation of the Contextual Teaching and Learning (CTL) model supported by visual media in teaching data presentation in tables to Grade III students at SD GMIM 1 Woloan. The study employed Classroom Action Research (CAR) based on the Kemmis and McTaggart model and was conducted in two cycles, each consisting of planning, action, observation, and reflection. The participants were 17 students, comprising 9 male and 8 female students. Data were collected through observations and learning outcome tests and analyzed using descriptive quantitative analysis based on mean scores and class-wide mastery percentages. The results showed that the mean learning outcome score increased from 69.76 in Cycle I to 82.35 in Cycle II. Class-wide mastery also increased from 52.94% to 82.35%. Teacher activity increased from 67% to 87%, while student activity increased from 59% to 82%. These improvements indicate that the implementation of CTL supported by visual media can serve as an alternative instructional approach for improving student engagement and mathematics learning outcomes in data presentation. The implication is that teachers need to integrate real-life contexts, visual media, collaborative activities, and targeted instructional support into primary mathematics instruction.

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INTRODUCTION

Primary education represents an important stage in developing the knowledge and skills that students need to support their learning at subsequent educational levels. In mathematics education, students are not only

expected to obtain correct answers but also to understand relationships among concepts, use representations, and apply knowledge to relevant situations. Mathematics instruction that provides opportunities for students to use multiple representations and connect information with meaningful situations can support the development of mathematical understanding (Schoenherr & Schukajlow, 2024; Schifter & Russell, 2022).

Mathematics at the primary school level is characterized by the need to establish connections between mathematical concepts and students' learning experiences. When instruction focuses primarily on symbols and procedures, students may experience difficulties in understanding the meaning of the concepts being taught. Therefore, the use of contexts that are closely related to students' experiences can serve as an alternative means of helping them connect new knowledge with familiar situations. Research on Contextual Teaching and Learning (CTL) indicates that a contextual approach can support conceptual understanding and mathematics learning outcomes among primary school students (Indriani et al., 2019; Rahmah & Ermawati, 2022).

These issues were identified through preliminary observations of mathematics instruction in Grade III at SD GMIM 1 Woloan. The learning process tended to be teacher-centered, and students were not yet optimally engaged in observing, processing, and presenting information. This condition was reflected in students' learning outcomes on the topic of data presentation in tables. Of the 17 students, only 6 students (35.29%) achieved the required level of mastery, while 11 students (64.70%) had not yet reached the Learning Objective Achievement Criteria (Kriteria Ketercapaian Tujuan Pembelajaran/KKTP) established by the school, which was 75. These data indicate that most students had not yet achieved the intended learning objectives for the topic of data presentation. These preliminary findings provide an empirical basis for the need to implement learning that gives students greater opportunities to interact directly with information and experiences related to the learning material.

Data presentation is one of the mathematical topics that enables students to interact with information derived from their immediate environment. Simple data concerning the number of family members, preferred types of food, favorite games, the number of students, or other information closely related to students' daily lives can be used as material for activities involving data collection, classification, and presentation. In primary school statistics education, context can influence how students understand and interpret data. Frischmeier and Schnell (2023) demonstrated that students' expectations regarding context can play a role in the data analysis process during statistics activities in primary school. Therefore, instruction on data presentation should consider not only the forms in which data are represented but also the contexts underlying the data.

One approach that can be used to connect learning materials with students' experiences is Contextual Teaching and Learning (CTL). CTL incorporates relevant experiences and contexts into the learning process, enabling students to connect the knowledge they are learning with situations that are familiar to them. In mathematics education, this approach can provide students with opportunities to construct understanding through activities such as observing problems, identifying information, engaging in discussions, connecting prior knowledge with new concepts, and applying concepts to different situations. Indriani et al. (2019) demonstrated that CTL can be used to improve students' conceptual understanding of fractions, while Malmia et al. (2020) reported the effectiveness of CTL in improving mathematics learning outcomes.

More recent studies have also demonstrated the continued relevance of CTL in primary mathematics education. Rahmah and Ermawati (2022) found an effect of the CTL model on primary school students' mathematics learning outcomes. Similarly, Rambe et al. (2022) examined the use of the CTL approach and reported its association with mathematics learning outcomes among primary school students. Meanwhile, Anggraita et al. (2024) reported that the implementation of CTL in mathematics instruction resulted in differences in learning outcomes compared with a comparison condition. These findings provide empirical support for the use of contextual learning to connect mathematical concepts with students' learning experiences.

Although learning contexts can help students connect concepts with their experiences, the information obtained still needs to be represented in forms that can be observed and interpreted. Visual representation is one

form of external representation that is widely used in mathematics education. Through a review of 130 empirical studies on visualization in mathematics education, Schoenherr and Schukajlow (2024) showed that external visualization may take the form of pictures, diagrams, concrete objects, or technology-based representations and may serve various purposes, including supporting conceptual understanding and problem solving. These findings indicate that visualization constitutes an important component of the teaching and learning process in mathematics.

The use of visual representations is also relevant at the primary school level because students encounter various types of information that can be represented through pictures, diagrams, tables, or other visual forms. Through an analysis of 3,844 visuals in primary school textbooks, Guo et al. (2018) demonstrated that visuals in instructional materials take various forms and serve both representational and interpretive functions. In mathematics education, representations created or used by students can also serve as means of expressing and constructing mathematical understanding. Schifter and Russell (2022) demonstrated that student-generated representations can play an important role in the process through which students construct mathematical generalizations.

The relationship between visualization and mathematical problem solving has also been examined among primary school students. Boonen et al. (2016) demonstrated the use of visual representations in mathematics problem-solving instruction at the primary school level. Kaitera and Harmoinen (2022) likewise showed that visual representations can be incorporated into heuristic strategies to develop mathematical problem-solving skills among primary school students. Thus, visual media do not merely function as tools for attracting students' attention but can also help them organize, represent, and interpret mathematical information.

The relationship between context and visual representation is particularly important in teaching data presentation. Data obtained from real-life situations need to be organized so that they can be read and interpreted. Tables constitute one form of representation that enables students to observe relationships between categories and the corresponding quantities of data. Frischmeier and Schnell (2023) demonstrated the importance of context in the data analysis process in primary education, while Schoenherr and Schukajlow (2024) showed that external representations, including relational and visual representations, can support the process of understanding and communicating mathematical information. Based on these findings, the use of real-life contexts combined with visual representations has both theoretical and empirical foundations for implementation in teaching data presentation.

The integration of CTL with visual media may provide complementary functions in the learning process. CTL provides the context that serves as a starting point for students to understand a problem, whereas visual media help organize and represent the information obtained from that context. In teaching data presentation, this integration can be implemented through activities such as observing data from the surrounding environment, identifying and classifying information, presenting data in tables, and reading and explaining information based on the resulting representations. This argument is consistent with research on CTL emphasizing the importance of context in mathematics education and research on visualization demonstrating the role of external representations in supporting mathematical understanding (Rahmah & Ermawati, 2022; Schoenherr & Schukajlow, 2024).

Although previous studies have demonstrated the benefits of CTL in mathematics education and the importance of visual representations in the learning process, there remains an opportunity to examine the integration of these two components in teaching data presentation to Grade III primary school students. Previous CTL studies have focused, among other topics, on conceptual understanding, fractions, two-dimensional shapes, and mathematics learning outcomes in general (Indriani et al., 2019; Malmia et al., 2020; Rahmah & Ermawati, 2022; Anggraita et al., 2024). Meanwhile, research on visualization has largely addressed problem solving, mathematical representation, and the characteristics of visualization in mathematics education (Boonen et al., 2016; Kaitera & Harmoinen, 2022; Schoenherr & Schukajlow, 2024). Given these research trends, a study specifically integrating CTL and visual media in teaching data presentation to Grade III students remains relevant, particularly in a learning context characterized by low levels of learning mastery.

Based on the empirical conditions and previous research, this study implements the Contextual Teaching and Learning (CTL) model using visual media in mathematics instruction on data presentation. The learning implementation is designed to connect data that are closely related to students' experiences with forms of representation that can be observed and understood. Therefore, this study aims to describe the implementation of the Contextual Teaching and Learning (CTL) model using visual media to improve the mathematics learning outcomes of Grade III students at SD GMIM 1 Woloan on the topic of data presentation.

METHODS

This study employed Classroom Action Research (CAR) based on the Kemmis and McTaggart model, which consists of four stages: planning, action, observation, and reflection. The study was conducted in two cycles. The results of the reflection at the end of each cycle were used as the basis for improving the actions implemented in the subsequent cycle (Rabgay & Kidman, 2023).

Figure 1. Classroom Action Research Cycle Based on the Kemmis and McTaggart Model



Source: Adapted from Kemmis and McTaggart

The study was conducted during the even semester of the 2025/2026 academic year, from March to April 2026, at SD GMIM 1 Woloan, Woloan I Urban Village, West Tomohon District, Tomohon City, North Sulawesi Province, Indonesia. The research subjects comprised all 17 Grade III students, consisting of 9 male and 8 female students. The subjects were selected based on the results of preliminary observations indicating low mathematics learning outcomes on the topic of data presentation. Of the 17 students, 6 students (35.29%) achieved the Learning Objective Achievement Criteria (KKTP), whereas 11 students (64.70%) had not yet achieved the minimum criterion of 75.

The intervention involved implementing the Contextual Teaching and Learning (CTL) model using visual media to teach data presentation. In each cycle, the learning process was carried out through the stages of planning, action, observation, and reflection. The implementation of CTL involved connecting the learning material with students' experiences and real-life situations through activities such as observing, questioning, gathering information, group work, modeling, reflection, and assessment. Visual media were used to assist students in observing, classifying, presenting, and understanding data in tabular form.

Data were collected through observation and learning outcome tests. Observations were conducted using observation sheets to record teacher and student activities during the learning process and to determine the extent to which the intervention was implemented. Learning outcome tests were administered at the initial stage and at the end of each cycle to identify changes in students' learning outcomes on the topic of data presentation.

The data were analyzed using descriptive quantitative analysis based on percentages. The percentage of achievement obtained from the observation data was calculated using the following formula:

$P = (F/N) \times 100\%$
 where P represents the percentage of achievement, F represents the score obtained, and N represents the maximum possible score. The observation results were categorized as very good (80%–100%), good (70%–79%), fair (60%–69%), poor (50%–59%), and very poor (<50%).

Student learning outcomes were analyzed based on individual mastery and class-wide mastery. Individual mastery was calculated using the following formula:

$KB = (T / T_t) \times 100\%$
 where KB represents the percentage of individual mastery, T represents the score obtained by the student, and Tt represents the maximum possible score.

Class-wide mastery was calculated using the following formula:

$P = (n / N) \times 100\%$
 where P represents the percentage of class-wide mastery, n represents the number of students who achieved the mastery criterion, and N represents the total number of students. A student was considered to have achieved mastery if the score was ≥ 75 , in accordance with the Learning Objective Achievement Criteria (KKTP) established by the school.

The intervention was considered successful when at least 80% of the students achieved learning mastery with a score of ≥ 75 and learning activities reached at least the good category, namely $\geq 70\%$. If these success indicators were not achieved, the results of the reflection were used as the basis for improving the intervention in the subsequent cycle.

RESULTS

his classroom action research was conducted with 17 Grade III students at SD GMIM 1 Woloan, consisting of 9 male and 8 female students. The intervention involved the implementation of the Contextual Teaching and Learning (CTL) model supported by visual media in teaching data presentation in tabular form. The study was conducted in two cycles. The results are presented based on the implementation of the learning process and changes in students' learning outcomes in each cycle.

Cycle I

Cycle I was conducted on March 31–April 1, 2026, with an allocation of 2×35 minutes. Based on the observation results, teacher activity reached 67% and was categorized as fair, whereas student activity reached 59% and was categorized as poor. The observations indicated that some students were still hesitant to present their work, teacher assistance to the groups was not evenly distributed, and students' involvement in completing the student worksheets (LKPD) was not yet optimal.

The learning outcome test administered at the end of Cycle I showed that 9 of the 17 students had achieved the KKTP score of 75, whereas 8 students had not yet achieved the criterion. The total score obtained by all students was 1,186 out of a maximum score of 1,700. Thus, the class mean score was $1,186 \div 17 = 69.76$. Class-wide mastery was calculated as $9 \div 17 \times 100\% = 52.94\%$.

Table 1. Learning Outcomes in Cycle I.

Cycle	Total Score Obtained	Maximum Score	Students Achieving Mastery	Mean Score	Class-Wide Mastery
I	1,186	1,700	9	69.76	52.94%

Source: Primary research data processed by the researchers, 2026

Based on these results, class-wide mastery in Cycle I was 52.94%, which remained below the research success criterion of at least 80% of students achieving a score of ≥ 75 . Therefore, the intervention in Cycle I was not considered successful. The reflection results indicated the need for improvements, particularly in ensuring more equitable group assistance, increasing student participation, and providing clearer opportunities for each group member to participate in the learning activities.

Cycle II

Cycle II was conducted on April 28, 2026, with an allocation of 2×35 minutes. Improvements to the intervention were implemented based on the reflection results from Cycle I. The teacher provided more evenly distributed assistance to each group by moving among the groups and rotating attention across them. In addition, each group member was assigned a specific role, namely leader, recorder, and presenter, so that student participation in the learning activities became more structured.

The observation results showed an improvement in the implementation of the learning process. Teacher activity increased from 67% in Cycle I to 87% in Cycle II, while student activity increased from 59% to 82%. These improvements indicate that the actions implemented in Cycle II were accompanied by increased student participation and improved implementation of the learning process.

The learning outcome test administered at the end of Cycle II showed that 14 of the 17 students had achieved the KKTP score of 75, whereas 3 students had not yet achieved the criterion. The total score obtained by all students was 1,400 out of a maximum score of 1,700. The class mean score was $1,400 \div 17 = 82.35$. Meanwhile, class-wide mastery was calculated as $14 \div 17 \times 100\% = 82.35\%$.

Table 2. Learning Outcomes in Cycle II

Cycle	Total Score Obtained	Maximum Score	Students Achieving Mastery	Students Achieving Mastery	Class-Wide Mastery
II	1,400	1,700	14	15	82.35%

Source: Primary research data processed by the researchers, 2026.

The results of Cycle II showed that class-wide mastery reached 82.35%, exceeding the established success criterion of at least 80% of students achieving a score of ≥ 75 . Teacher activity reached 87%, while student activity reached 82%; both were categorized as very good. Since the success criteria had been achieved, the study was concluded after Cycle II.

Comparison of the Results of Cycle I and Cycle II

A comparison of learning outcomes between Cycle I and Cycle II showed an improvement following the implementation of the revised intervention. The total student score increased from 1,186 in Cycle I to 1,400 in Cycle II. The mean score increased from 69.76 to 82.35, representing an increase of 12.59 points. The number of students achieving the KKTP increased from 9 to 14, while class-wide mastery increased from 52.94% to 82.35%, representing an increase of 29.41 percentage points.

Table 3. Comparison of Learning Outcomes between Cycle I and Cycle II

Cycle	Total Score Obtained	Maximum Score	Students Achieving Mastery	Students Achieving Mastery	Class-Wide Mastery
I	1,186	1,700	9	10	52.94%
II	1,400	1,700	14	15	82.35%

Source: Primary research data processed by the researchers, 2026.

The improvement in learning outcomes occurred alongside an increase in learning activity. Teacher activity increased by 20 percentage points, from 67% to 87%, whereas student activity increased by 23 percentage points, from 59% to 82%. These changes were associated with improvements in the implementation of the

intervention in Cycle II, particularly the more equitable distribution of group assistance and the assignment of specific roles within each group. Thus, the research data indicate that the implementation of CTL supported by visual media in teaching data presentation to Grade III students at SD GMIM 1 Woloan was accompanied by improvements in learning outcomes and student engagement from Cycle I to Cycle II.

Discussion

The implementation of Contextual Teaching and Learning (CTL) supported by visual media in teaching data presentation demonstrated positive changes in the learning process and outcomes of Grade III students at SD GMIM 1 Woloan. The mean score increased from 69.76 in Cycle I to 82.35 in Cycle II, while class-wide mastery increased from 52.94% to 82.35%. These improvements occurred following revisions to the intervention in Cycle II based on the reflection results from Cycle I. This finding is consistent with Rahmah and Ermawati (2022), who found that the implementation of CTL influenced mathematics learning outcomes among primary school students. The finding is also consistent with the meta-analysis conducted by Nur (2024), which indicated that CTL has an effect on mathematics learning outcomes among primary school students. Thus, the improvement in learning outcomes observed in this study follows a pattern consistent with previous research on the implementation of contextual learning in mathematics education.

The findings from Cycle I indicate that the implementation of CTL did not yet fully result in the expected level of student engagement. Teacher activity reached 67%, while student activity reached 59%. The observations indicated that some students were still hesitant to communicate their answers, participation within groups was uneven, and several students were not actively involved in completing the student worksheets (LKPD). These conditions suggest that connecting learning materials with instructional contexts does not automatically ensure active participation among all students. In contextual learning, students need opportunities to observe, ask questions, engage in discussion, connect information with their experiences, and communicate their thinking. Putri et al. (2022), through a meta-analysis, showed that CTL and Realistic Mathematics Education contribute to students' mathematical communication skills. Therefore, student engagement in learning activities is an important component in obtaining the potential benefits of context-based learning approaches.

The low level of student activity in Cycle I provided the basis for revising the intervention in Cycle II. Rather than simply continuing the same learning activities, the teacher modified the approach to group assistance by moving more systematically among the groups and assigning clear roles as leader, recorder, and presenter. These changes made responsibilities within the groups more structured and provided students with broader opportunities to participate. This finding is consistent with Susilawati (2023), who reported that the implementation of CTL through classroom action research can improve learning activity, student motivation, and learning outcomes. In the context of this study, these improvements indicate that the successful implementation of CTL depends not only on the stages of the model itself but also on how teachers manage interactions and provide support throughout the learning process.

The changes in instructional strategies in Cycle II were accompanied by an increase in teacher activity from 67% to 87% and student activity from 59% to 82%. These increases indicate that the learning process became more structured after the teacher implemented improvements based on the reflection results. Students were given clearer roles within their groups, while the teacher adopted a more systematic pattern of assistance. Khasanah et al. (2023), in their study of contextual learning in mathematical statistical literacy, also showed that learning activities connecting instructional content with context can provide opportunities for students to read, interpret, and use mathematical information. This finding is relevant to the present study because data presentation requires students to understand information before representing it in tabular form.

The improvement in learning outcomes from Cycle I to Cycle II can be related to changes in the learning experiences provided to students. In Cycle II, students did not merely receive explanations about data presentation but were actively involved in observing information, discussing data, completing student worksheets, and presenting

their work. These activities provided opportunities for students to process information before producing their answers. Through a meta-analysis, Parhusip and Hardini (2020) showed that contextual learning can improve primary school students' mathematical understanding. Meanwhile, Tamur et al. (2021), through a meta-analysis, reported a positive effect of CTL on students' mathematical abilities. These findings provide empirical support for understanding how mathematics instruction that connects concepts with context and student activities can support mathematical understanding.

The characteristics of data presentation also make the use of visual representations relevant to the learning process. Students need to understand the relationship between the information obtained and the way in which that information is represented. In this study, PowerPoint was used to display data visually before students processed and presented the information in tabular form. The use of this medium provided a common object of observation during the learning process. Jerika and Lestari (2022) reported that the use of interactive PowerPoint in primary mathematics education was associated with students' learning outcomes and motivation. This finding reinforces the role of visual media as part of the learning environment that can support students' interaction with mathematical information.

The use of visual media in this study is also relevant to international research on mathematical representations and digital technology. Buchholtz et al. (2021) explained that digital technology can expand the possibilities for representation in mathematics education, including through the visualization of mathematical objects and information. However, the benefits of technology do not lie solely in the devices used but rather in how the technology is integrated into students' mathematical activities. This perspective is consistent with the implementation of the present study. PowerPoint was not used as a substitute for learning activities but was incorporated into the CTL sequence through observation, discussion, completion of student worksheets, and data presentation. Thus, the function of visual media in this study is more appropriately understood as supporting the processes of understanding and representing information rather than as an independent factor.

The relationship between the learning context and the use of media is also important to consider. Putri et al. (2024), through a meta-analysis of 14 studies involving 2,501 students, found a positive effect of a multi-contextual approach in mathematics education. This finding suggests that learning contexts can play an important role in helping students understand mathematical concepts. In the present study, the context was introduced not only through learning activities but also reinforced through the visualization of information using PowerPoint. The combination of these components provided students with opportunities to observe information, discuss it within their groups, and subsequently process it into a more structured form of data presentation.

The increase in the number of students achieving mastery, from 9 students in Cycle I to 14 students in Cycle II, was also associated with changes in teacher assistance. In Cycle II, the teacher provided more targeted support to students who experienced difficulties in understanding instructions, used simpler language, and ensured the participation of each group member. These changes indicate that the implementation of an instructional model requires adjustments based on students' responses during the learning process. A systematic review by Stringer et al. (2022) of primary school teachers' experiences with digital technology integration showed that the use of technology in teaching cannot be separated from teachers' pedagogical decisions. In this study, the teacher's decisions regarding group organization, instructional assistance, and media use formed part of the overall intervention that contributed to changes in the learning process.

Compared with the initial condition, learning mastery increased from 35.29%, or 6 students, to 52.94%, or 9 students, in Cycle I and subsequently reached 82.35%, or 14 students, in Cycle II. This increase indicates progressive improvement in learning mastery throughout the intervention. A similar pattern of improvement across cycles has also been reported in classroom action research involving contextual learning in primary mathematics education. However, the magnitude of the improvement in this study cannot be directly compared with that of previous studies because of differences in the number of participants, learning materials, instruments, classroom

characteristics, and school contexts. Previous studies are therefore used as points of comparison to examine the consistency of the observed pattern and to provide context for interpreting the findings of the present study.

Although learning outcomes improved, the findings should be interpreted in accordance with the characteristics of the research design. The study was conducted in a single class and did not employ a comparison group. Furthermore, CTL and visual media were implemented simultaneously and were accompanied by changes in group assistance, role assignments, use of student worksheets, and discussion activities. Therefore, the improvement in learning outcomes cannot be attributed separately to CTL or PowerPoint. A more appropriate interpretation is that the overall improvement in the instructional intervention in Cycle II was associated with improvements in students' learning processes and outcomes. This limitation also indicates that the findings are more appropriately used to explain changes in learning within the specific classroom context studied rather than to make causal generalizations to a broader population.

Overall, the increase in teacher activity from 67% to 87%, student activity from 59% to 82%, mean scores from 69.76 to 82.35, and class-wide mastery from 52.94% to 82.35% indicates improvement in both the learning process and learning outcomes. These findings are consistent with previous research indicating that CTL can support students' learning outcomes and mathematical abilities (Rahmah & Ermawati, 2022; Nur, 2024; Tamur et al., 2021), as well as research demonstrating the role of digital and visual media in supporting mathematical representation and learning activities (Jerika & Lestari, 2022; Buchholtz et al., 2021). In the context of this study, CTL supported by visual media can be implemented in Grade III data presentation instruction because it provides opportunities for students to observe information, engage in discussion, process data, and present their findings. Its implementation nevertheless requires effective group management, appropriate teacher assistance, and careful selection of media that are aligned with the characteristics of the learning material and the students.

CONCLUSION

Based on the findings, the implementation of Contextual Teaching and Learning (CTL) supported by visual media in teaching data presentation demonstrated improvements in the learning process and learning outcomes of Grade III students at SD GMIM 1 Woloan. The mean learning outcome score increased from 69.76 in Cycle I to 82.35 in Cycle II, while class-wide mastery increased from 52.94% to 82.35%. Teacher activity increased from 67% to 87%, whereas student activity increased from 59% to 82%. These improvements occurred following revisions to the intervention in Cycle II through more equitable group assistance, the assignment of specific roles within groups, the use of visual media, and more targeted support for students.

The contribution of this study lies in the implementation of CTL supported by visual media in teaching data presentation within a Grade III primary school classroom context. The findings indicate that activities involving visual observation of information, data discussion, collaborative task completion, and data presentation in tabular form can be integrated into contextual learning. The practical implication is that teachers may use CTL supported by visual media as an alternative approach for teaching data presentation, while paying attention to group management, student assistance, and the alignment of the media with the characteristics of the learning material. Visual media should not be used merely to deliver information but should be integrated with activities that encourage students to process, discuss, and communicate mathematical information.

This study has several limitations. It was conducted in a single class involving 17 students and did not include a comparison group. In addition, CTL and visual media were implemented simultaneously, making it impossible to separate the contribution of each component to the improvement in learning outcomes. Future research could involve a larger number of students and schools and employ experimental or quasi-experimental designs with comparison groups. Further studies could also compare the implementation of CTL with and without visual media and examine its effects on other mathematical abilities, such as conceptual understanding, mathematical communication, problem solving, and higher-order thinking skills.

REFERENCES

- Anggraita, R. L., Wahyuni, S., Mumpuni, D. A., Murtiyasa, B., & Sumardi. (2024). Efektivitas model Contextual Teaching and Learning (CTL) terhadap hasil belajar matematika materi bangun datar pada siswa kelas V sekolah dasar. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 9(3). <https://doi.org/10.23969/jp.v9i03.16737>
- Boonen, A., Reed, H., Schoonenboom, J., & Jolles, J. (2016). It's not a math lesson—we're learning to draw! Teachers' use of visual representations in instructing word problem solving in sixth grade of elementary school. *Frontline Learning Research*, 4(5), 34–61. <https://doi.org/10.14786/flr.v4i5.245>
- Chu, Y. L. L., & Toh, T. L. (2020). A framework for designing mathematics instruction using comics at the primary school level. *JRAMathEdu: Journal of Research and Advances in Mathematics Education*, 5(3), 218–230. <https://doi.org/10.23917/jramathedu.v5i3.11373>
- Frischemeier, D., & Schnell, S. (2023). Statistical investigations in primary school—the role of contextual expectations for data analysis. *Mathematics Education Research Journal*, 35(Suppl. 1), 217–242. <https://doi.org/10.1007/s13394-021-00396-5>
- Ghassani, D., Kurniasih, & Fitriani, A. D. (2019). Penerapan pendekatan CTL untuk meningkatkan pemahaman konsep matematis siswa kelas V SD. *Jurnal Pendidikan Guru Sekolah Dasar*, 4(3). <https://doi.org/10.17509/jpgsd.v4i3.22909>
- Guo, D., Wright, K. L., & McTigue, E. M. (2018). A content analysis of visuals in elementary school textbooks. *The Elementary School Journal*, 119(2), 244–269. <https://doi.org/10.1086/700266>
- Indriani, R., Puspita, A. M. I., Ninawati, M., Handayani, H., & Agusfianuddin, A. (2019). Contextual teaching and learning untuk meningkatkan kemampuan pemahaman konsep pecahan. *Kalamatika: Jurnal Pendidikan Matematika*, 4(1), 109–116. <https://doi.org/10.22236/kalamatika.vol4no1.2019pp109-116>
- Jerika, E., & Lestari, D. (2022). The use of interactive PowerPoints to increase elementary school student's learning outcomes and motivation in mathematics during the pandemic. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 6(2), 1403–1418. <https://doi.org/10.31004/cendekia.v6i2.1364>
- Kaitera, S., & Harmoinen, S. (2022). Developing mathematical problem-solving skills in primary school by using visual representations on heuristics. *LUMAT: International Journal on Mathematics, Science and Technology Education*, 10(2), 111–146. <https://doi.org/10.31129/LUMAT.10.2.1696>
- Kaminski, J. A., & Sloutsky, V. M. (2020). The use and effectiveness of colorful, contextualized, student-made material for elementary mathematics instruction. *International Journal of STEM Education*, 7, Article 6. <https://doi.org/10.1186/s40594-019-0199-7>
- Khasanah, S. U., Murtiyasa, B., Sumardi, S., Yati, Y., & Aminurriyah, S. (2023). Pembelajaran kontekstual untuk mengembangkan kemampuan literasi statistika matematika peserta didik sekolah dasar. *Jurnal Basicedu*, 7(1), 583–592. <https://doi.org/10.31004/basicedu.v7i1.4624>
- Malmia, W., Latbual, J., Hentihu, V. R., & Loilatu, S. H. (2020). Efektifitas pembelajaran Contextual Teaching and Learning (CTL) terhadap hasil belajar matematika siswa. *Uniqbu Journal of Exact Sciences*, 1(2), 31–39. <https://doi.org/10.47323/ujes.v1i2.26>
- Muflihah, S., & Lepith, A. (2019). Penerapan pendekatan Contextual Teaching and Learning dalam meningkatkan hasil belajar matematika pada materi luas dan keliling bangun datar. *Indonesian Journal of Instructional Media and Model*, 1(1), 45–55. <https://doi.org/10.32585/ijimm.v1i1.317>
- Nasirudin, A., Rahmawati, I., & Suyitno, S. (2019). Keefektifan model Contextual Teaching and Learning (CTL) terhadap hasil belajar matematika materi pecahan. *Journal for Lesson and Learning Studies*, 2(2), 150–159. <https://doi.org/10.23887/jlls.v2i2.18620>

- Nur, M. A. (2024). Meta analisis pengaruh model pembelajaran Contextual Teaching and Learning (CTL) terhadap hasil belajar matematika siswa sekolah dasar. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, 4(1), 151–160. <https://doi.org/10.51574/kognitif.v4i1.1409>
- Parhusip, Y. P., & Asri Hardini, A. T. (2020). Meta analisis efektivitas pembelajaran kontekstual terhadap kemampuan pemahaman matematika bagi siswa sekolah dasar. *Mimbar Ilmu*, 25(3), 319–326. <https://doi.org/10.23887/mi.v25i3.27954>
- Pedersen, M. K., Bach, C. C., Gregersen, R. M., Højsted, I. H., & Jankvist, U. T. (2021). Mathematical representation competency in relation to use of digital technology and task design—A literature review. *Mathematics*, 9(4), Article 444. <https://doi.org/10.3390/math9040444>
- Putri, L. I., Dwiningrum, S. I. A., Retnawati, H., Begimbetova, G. A., & Salem, S. (2025). How is the impact of applying contextual approach in mathematics learning? *Attadrib: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, 8(1), 237–254. <https://doi.org/10.54069/attadrib.v8i1.888>
- Putri, N. S., Juandi, D., & Jupri, A. (2022). The implementation effect of realistic mathematics education and contextual teaching and learning approaches on the students' mathematical communication ability: A meta-analysis. *Al-Jabar: Jurnal Pendidikan Matematika*, 13(2), 383–400. <https://doi.org/10.24042/ajpm.v13i2.13562>
- Rabgay, T., & Kidman, G. (2023). Multiple iterations and messiness in the implementation of action research by Bhutanese secondary science teachers. *Discover Education*, 2(1), Article 49. <https://doi.org/10.1007/s44217-023-00077-4>
- Rahmah, Z. A., & Ermawati, I. R. (2021). Pengaruh model pembelajaran Contextual Teaching and Learning terhadap hasil belajar matematika siswa sekolah dasar. *Jurnal Basicedu*, 6(1), 364–371. <https://doi.org/10.31004/basicedu.v6i1.1916>
- Rambe, R. B. B., Firman, & Desyandri. (2023). Dampak penggunaan pendekatan Contextual Teaching and Learning (CTL) dan gaya belajar terhadap hasil belajar matematika siswa sekolah dasar. *Didaktik: Jurnal Ilmiah PGSD STKIP Subang*, 8(2), 2930–2939. <https://doi.org/10.36989/didaktik.v8i2.615>
- Schoevers, E. M., Leseman, P. P. M., & Kroesbergen, E. H. (2020). Enriching mathematics education with visual arts: Effects on elementary school students' ability in geometry and visual arts. *International Journal of Science and Mathematics Education*, 18, 1613–1634. <https://doi.org/10.1007/s10763-019-10018-z>
- Schoenherr, J., & Schukajlow, S. (2024). Characterizing external visualization in mathematics education research: A scoping review. *ZDM–Mathematics Education*, 56, 73–85. <https://doi.org/10.1007/s11858-023-01494-3>
- Schifter, D., & Russell, S. J. (2022). The centrality of student-generated representation in investigating generalizations about the operations. *ZDM–Mathematics Education*, 54, 1289–1302. <https://doi.org/10.1007/s11858-022-01379-x>
- Stringer, L. R., Lee, K. M., Sturm, S., & Giacaman, N. (2022). A systematic review of primary school teachers' experiences with digital technologies curricula. *Education and Information Technologies*, 27(9), 12585–12607. <https://doi.org/10.1007/s10639-022-11127-z>
- Tamur, M., Kurnila, V. S., Marzuki, M., Jehadus, E., Ndiung, S., Pareira, J., & Syaharuddin, S. (2021). Learning from the past: Meta-analysis of contextual teaching-learning of the past decade. *International Journal of Education and Curriculum Application*, 4(1), 1–10. <https://doi.org/10.31764/ijeca.v4i1.3981>