IMPLEMENTATION OF CONTEXTUAL LEARNING ASSISTED BY PAMADI MEDIA ON BAR CHART TOPICS TO TRAIN DATA PRESENTATION AND ANALYSIS SKILL AMONG FIFTH-GRADE ELEMENTARY SCHOOL STUDENTS

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ABSTRACT

The ability to present and analyze data is a crucial competency in elementary school mathematics, particulary regarding bar charts. This study employed a quantitative approach with a descriptive quantitative design, involving 27 fifth-grade elementary school students. Data were collected through assessments of student worksheets (LKPD), a bar chart evaluation test, and observation sheets tracking student activity during lesson. Research instruments included rubrics for data presentation and analysis skills, evaluation questions, and student activity observation sheets. Data were analyzed using descriptive statistics, specifically mean scores, learning mastery percentages, and student activity percentages. The result indicate that contextual learning supported by PAMADI media effectively fosters data presentation and analysis skills among fifth-grade students. This approach has the potential to help students understand data as information derived from real-life situations within the school environment—specifically through activities such as data collection, tallying, creating bar charts, and drawing simple conclusions from the data. These findings are expected to offer an alternative approach to mathematics instruction that is more concrete, contextual, and focused on developing data literacy among elementary school students.

Keywords: bar chart, PAMADI media, contextual learning, elementary school, data presentation.

ABSTRAK

Kemampuan menyajikan dan menganalisis data merupakan salah satu kompetensi penting dalam pembelajaran matematika sekolah dasar, terutama pada materi diagram batang. Penelitian ini menggunakan pendekatan kuantitatif dengan desain deskriptif kuantitatif. Subjek penelitian adalah murid kelas 5 sekolah dasar yang berjumlah 27 anak. Data dikumpulkan melalui penilaian LKPD, tes evaluasi materi diagram batang, dan lembar observasi aktivitas murid selama pembelajaran. Instrumen penelitian mencakup rubrik kemampuan menyajikan data, rubrik kemampuan menganalisis data, soal evaluasi, dan lembar observasi aktivitas murid.

Data dianalisis menggunakan statistik deskriptif berupa rata-rata, persentase ketuntasan belajar, dan persentase aktivitas murid. Hasil penelitian menunjukkan bahwa pembelajaran kontekstual berbantuan media PAMADI mampu melatih kemampuan menyajikan dan menganalisis data pada murid kelas 5 sekolah dasar. Pembelajaran kontekstual berbantuan media PAMADI berpotensi membantu murid memahami data sebagai informasi yang berasal dari situasi nyata di lingkungan sekolah, khususnya melalui aktivitas mengumpulkan data, mencatat turus, menyajikan diagram batang, dan menarik kesimpulan sederhana berdasarkan data. Temuan penelitian ini diharapkan dapat memberikan alternatif pembelajaran matematika yang lebih konkret, kontekstual, dan berorientasi pada literasi data murid sekolah dasar.

Kata Kunci: diagram batang; media PAMADI; pembelajaran kontekstual; sekolah dasar; penyajian data.

A. Background

Mathematics in primary school serves not only to develop numeracy skills but also to foster logical, systematic, critical, and evidence-based thinking abilities. A key area within mathematics education is data analysis and probability. In Phase C, students are guided to sort, compare, present, and analyze data—whether regarding quantities of objects or measurement results—using formats such as images, pictograms, bar charts, and frequency tables to derive information (Ministry of Education, Culture, Research, and Technology, 2024). These learning outcomes indicate that instruction on bar charts should not be limited to the skill of drawing the charts themselves; rather, it must also encompass the ability to understand the data, interpret relationships between categories, compare values, and draw conclusions from the information presented.

In the context of primary education, the ability to understand data is becoming increasingly important, as students need to become accustomed early on to making decisions based on verifiable information. Recent literature on K-12 data literacy emphasizes the need to integrate data literacy into the curriculum through activities that utilize tools, data, and contexts appropriate for the students' age (Dorsey et al., 2025). Studies on the statistical knowledge of primary school students also indicate that statistical graphs are a key subject of analysis in primary education research (Londoño & Alsina, 2023). Consequently, bar

charts can serve as a valuable medium for training students to read, construct, and interpret data in a progressive manner.

However, instruction on data presentation in primary schools risks becoming overly abstract if students are merely asked to read tables or draw diagrams without experiencing the data collection process firsthand. Such an approach can lead students to view data as a collection of numbers detached from their daily lives. Consequently, there is a need for instruction that provides hands-on experience in collecting data, recording tallies, presenting data in bar charts, and analyzing the resulting information. Direct student involvement in data collection is crucial for transforming abstract numbers into meaningful visual information (Fitzallen, N. & Watson, J., 2021). Empirical research further demonstrates that when students collect data themselves, the learning of basic statistics in Indonesia becomes more concrete and contextual (Juandi & Latifah, 2022). Addressing this issue, lessons on bar charts should be designed around contexts familiar to students—such as a school canteen scenario involving the determination of the food items most popular among the student body.

One relevant approach to addressing this need is contextual learning. Contextual learning uses real-life experiences as a foundation for understanding mathematical concepts. In this study, the school canteen serves as the context for a problem-based activity where students conduct a simple survey on their classmates' favorite foods, record frequencies using tally marks, organize the data into a table, present it in a bar chart, and interpret the results. PAMADI (Magnetic Diagram Board) is a visual and manipulative learning tool designed to help students present data as bar charts in a concrete manner. Made from a cardboard base covered with a magnetic sheet, the tool allows students to construct bar charts using magnetic blocks based on the data they have collected. The use of such concrete aids helps bridge the gap between abstract concepts and concrete representations (Hidayah, N. & Rahmawati, E., 2025).

In this study, contextual learning is implemented through activities that link the concept of data presentation to real-life situations

within the school environment. Instead of simply being presented with data in the form of tables or charts, students are actively involved in gathering data firsthand through a simple survey regarding their classmates' favorite foods. This activity provides students with a tangible experience, helping them understand that data originates from observable phenomena in everyday life. Conducting surveys within the school environment can help children grasp the function of data in real-world contexts (Makar, 2021). Simple surveys focusing on immediate phenomena at school are also effective in enhancing data literacy awareness among elementary school students (Sari & Siregar, 2023).

The implementation of contextual learning involved several key activities: identifying issues regarding the school canteen, determining food categories for observation, conducting inter-group interviews, recording results using tally marks, constructing frequency tables, presenting data in bar charts, and drawing conclusions based on the gathered data. Through this process, students not only learned to create bar charts but also gained an understanding of the meaning of data and the connection between data and simple decision-making. A contextual approach was selected because mathematics instruction in primary schools becomes more meaningful when students personally experience the learning process. According to Salsabila et al. (2024), contextual learning can enhance the understanding of mathematical concepts through real-world situations. Furthermore, collaborative activities during the survey and data presentation phases fostered active student engagement throughout the lesson.

Operationally, the PAMADI tool comprises several key components: the chart title, x- and y-axes, data categories (e.g., types of objects or foods), frequency, chart scale, a legend, and a conclusion section. In this tool, each block represents a single unit of data frequency, enabling students to more easily grasp the relationship between the data quantity and the height of the bars on the chart. The PAMADI tool is adjustable and reusable; bar charts are constructed by attaching magnetic blocks to the board based on data collected by students, and these blocks can

subsequently be removed for use with different datasets. Additionally, the sections for the title, data categories, legend, and conclusion are covered with transparent overlays that allow for writing with non-permanent markers, which can be erased after use. This tool serves as an aid to make the data presentation process more concrete and observable for students. Physical and visual manipulative tools consistently facilitate the transition in student understanding from the abstract to the concrete (Carbonneau, K. J. & Marley, S. C., 2022). The PAMADI tool is also highly relevant, as concrete visual aids are well-suited for teaching data presentation at the elementary school level (Wijaya & Putri, 2024).

The research gap addressed in this study lies in the need for a model for presenting bar graph material that integrates real-world contexts, student-led data collection activities, visual aids or manipulatives, and the simultaneous assessment of skills in both presenting and analyzing data. While previous research on contextual mathematics learning has largely emphasized general learning outcomes, this study focuses specifically on the data presentation and analysis skills of fifth-grade elementary school students. This article is expected to offer practical contributions to teachers by helping them design data-related lessons that are concrete, contextual, and centered on student activities.

B. Method

This study employs a quantitative approach with a descriptive quantitative design. This design was selected because the study aims to describe students' proficiency in presenting and analyzing data—specifically regarding bar charts—after undergoing contextual learning supported by PAMADI media, rather than testing for causal effects. Consequently, the research findings are presented in terms of average scores, mastery percentages, and percentages of student activity.

The research subjects consisted of 27 fifth-grade students participating in a lesson on bar charts. Purposive sampling was used to select the subjects, based on the fact that the class had reached the topic of data analysis and probability within the Phase C mathematics curriculum.

The variables observed included the ability to present data, the ability to

analyze data, and student activity during the lesson. Data presentation skills encompassed accuracy in data collection, recording frequencies using tally marks, constructing frequency tables, determining chart titles, plotting bar charts according to frequencies, and applying appropriate labels. Data analysis skills included reading values from the chart, identifying the highest and lowest categories, comparing two or more categories, calculating differences, drawing conclusions, and offering recommendations or simple solutions based on the data within the problem context.

The learning procedure is carried out in several stages. First, the teacher presents a contextual problem regarding a school canteen that wants to identify the food items most preferred by students. Second, students are divided into groups and compile a list of food items to be observed. Each group is assigned a different food category, such as main meals, sweets, snacks, traditional treats, ice cream, and beverages. Third, students conduct inter-group interviews or simple surveys among their classmates. Fourth, students record the survey results using tally marks and construct a frequency table. Fifth, students use the PAMADI tool to present the data in the form of a bar chart. Sixth, students analyze the chart by answering questions regarding the most and least frequent food types, frequency comparisons, differences, and conclusions. Seventh, students complete an individual evaluation task to assess their proficiency levels following the lesson.

The data collection techniques employed in this study consisted of tests and instruments for observing student activity. Combining quantitative test data with observations of student activity provides a comprehensive overview of the students' mathematics learning process in the classroom (Bokhove, 2022). Prior to use in the study, all instruments—including the student worksheet (LKPD) assessment rubric, evaluation questions, and student activity observation sheets—underwent content validity testing via expert review. Expert lecturers conducted the validation to assess the appropriateness of the material, construction, and language. Tests were used to assess students' ability to present and analyze data based on their performance on the student

worksheets and evaluation questions regarding bar charts. Meanwhile, observations were conducted using student activity observation sheets to monitor student engagement and collaboration during the learning process.

The research data were analyzed using quantitative descriptive analysis techniques. The analysis covered the results of the student worksheet assessments, student evaluations, and student activity observations.

C. Result and Discussion

Result

1. Implementation and Student Activities in Learning

The lesson began with the presentation of a scenario involving the school canteen, followed by data collection on favorite foods, tallying, the creation of a frequency table, the construction of a bar chart using PAMADI media, and an analysis of the results. Student activities during the lesson were monitored using an observation sheet. A summary of the observation results is presented in Table 1.

Table 1 Observation Result

Activity	Score	Max. Score	Percentage	Category
Participation in interviews/surveys and group discussions.	98	100	100%	Advanced
Active participation in constructing bar charts using PAMADI media.	96	100	100%	Advanced
Ability to communicate analysis results	90	100	100%	Advanced
Average student activity	94	100	100%	Advanced

Based on Table 1, the percentage of student activity during the lesson reached 100%, falling into the "mastery achieved" category. The strongest aspects of student activity were observed in participation in interviews/surveys and group discussions, whereas the aspect requiring further guidance was the ability to present analysis results.

2. Ability to Present Data

The ability to present data was analyzed based on the results of student worksheets (LKPD) and/or evaluation tests that measured students' ability to convert survey data into frequency tables and bar charts. A summary of indicator achievement is presented in Table 2.

Table 2 Achievement of the Data Presentation Ability Indicator

Indicator	Average Score	Percentage	Category	Interpretation
Accuracy of data collection using ladders according to categories	98	96%	Advanced	Almost all students have completed it.
Ability to determine the title, categories, and scale of a diagram.	75	70%	Developing	The majority of students have completed it
Accuracy of bar chart presentation on the PAMADI medium.	80	85%	Capable	Almost all students have completed it.
Average ability to present data	84	83.67 %	Capable	Two indicators have been completed, and one indicator remains incomplete.

Table 2 indicates that the students' ability to present data falls into the "Mastered" category. The indicator with the highest achievement was the accuracy of data collection using tally marks according to categories, whereas the indicator with the lowest achievement was the ability to determine the chart's title, categories, and scale. These findings suggest that students were enthusiastic about the data collection phase—driven by contextual learning directly linked to their daily lives—while the process of defining the chart's components requires further intensive practice to enhance student proficiency.

3. Data Analysis Skills

Data analysis skills were measured through questions requiring students to interpret information from a bar chart, identify categories with specific frequencies, compare categories, determine differences, and draw conclusions. A summary of the results is presented in Table 3.

Table 3 Achievement of the Data Analysis Skill Indicator

Indicator	Average Score	Percentage	Category	Interpretation
Ability to read values from a bar chart	100	100%	Advanced	All students have completed
Ability to identify the data with the highest and lowest values	100	100%	Advanced	All students have completed
Accuracy in determining the difference between categories	100	100%	Advanced	All students have completed

Ability to draw conclusions based on data	80	66%	Developing	Some students have completed it
Accuracy of providing logical recommendations or solutions based on data.	80	66%	Developing	Some students have completed it
Average data analysis ability	92	86%	Advanced	Three indicators have been completed, and two indicator remains incomplete.

Based on Table 3, the students' ability to analyze data reached 86%, falling into the "Advanced" category. The students were generally able to read values from diagrams, identify the highest and lowest data points, and determine the differences between categories; however, some still struggled with drawing conclusions and providing logical recommendations or solutions based on the data.

4. Evaluation Results

Individual evaluation results are used to assess students' final achievements following instruction. A summary of the evaluation results is presented in Table 4.

Table 4 Evaluation Result

Evaluation Component	Score/Result
Number of students	27
Average score	90
Highest score	100
Lowest score	50
Number of students who have completed	24
Number of students who have not yet completed	3
Completion percentage	89.89%
Minimum Mastery Criterion (KKM) score	76

The evaluation results indicate an average student score of 90, with a pass rate of 89.9%. When compared to the mastery criterion of 89.89%, the students' achievement falls into the "Advanced" category.

Discussion

Conceptually, contextual learning supported by PAMADI media rests on a sound basis because students are not simply presented with ready-made diagrams; instead, they engage in the complete data-handling process: identifying data objects, collecting data, recording frequencies, constructing bar charts, and interpreting information. This sequence is crucial because data-handling skills in elementary school students develop through concrete experiences that allow them to perceive the connection between real-world events and mathematical

representations; linking subject matter to real-life experiences can enhance students' cognitive engagement (Ramda, A. H. et al., 2024).

Research findings indicate that students' ability to present data falls into the "Proficient" category, with an average score of 84 and an achievement rate of 83.67%. High performance on indicators regarding data collection accuracy and the use of tally marks (96%) demonstrates that utilizing contextual problems relevant to students—such as a canteen food survey—renders the process meaningful and easily comprehensible. The use of the concrete PAMADI aid proved effective in helping students visualize frequency as bar height, enabling them to grasp that each block represents a specific quantity within a category. This provides empirical evidence that physical aids consistently enhance student proficiency in abstract topics like data representation (Byrne, B. et al., 2023). However, the ability to determine chart titles, categories, and scales remained the lowest-performing area (70%, or the "Developing" category). This underscores that, while physical aids facilitate visualization, elementary students still require explicit scaffolding to construct and interpret the abstract conventions of graphical representations.

Furthermore, students' data analysis skills fall into the "Proficient" category, with an average score of 92 and an achievement rate of 86%. An interesting pattern regarding cognitive levels emerges from these findings. Students demonstrate strong mastery of direct factual data interpretation, evidenced by a 100% completion rate on the indicator for reading chart values. Conversely, achievement is lower—at 66% or the "Developing" category—for indicators requiring comparative and projective reasoning, such as drawing conclusions and proposing logical solutions. This pattern indicates that students find direct data reading easier than high-level reasoning; therefore, future instruction and practice should emphasize guiding students to reason about the implications of data for decision-making. A common discrepancy exists where students are procedurally proficient (e.g., in plotting data) yet conceptually weak (e.g., in reasoning), necessitating instructional intervention (Wulandari, S. et al., 2024). Moreover, data literacy is not

merely a technical or procedural skill but rather a capacity for reasoning and decision-making (Ge, Y. et al., 2026).

The findings of this study align with previous research on data literacy, statistical graphs, and contextual mathematics learning. Dorsey et al. (2025) emphasize that K-12 data literacy requires curriculum integration, appropriate tools, and datasets relevant to students' ages. A study by Londono and Alsina (2023) also identifies statistical graphs as essential elements of learning at the primary level. Thus, using the context of favorite foods in the school canteen can serve as a simple dataset that is both relevant and meaningful for fifth-grade students.

In terms of instructional practice, the school canteen context offers students the opportunity to realize that data is used to address real-world problems. Students do not merely draw charts to fulfill an assignment; rather, they grasp the rationale behind data collection, the methods of organizing data, and how the results inform recommendations. This is supported by classroom observation notes; for instance, during the analysis phase, some students offered logical recommendations through spontaneous remarks such as, "Since donuts are the most popular, the canteen lady should stock more of them tomorrow in the 'sweets' category." Conversely, regarding the lowest performance indicator—data presentation—observations revealed common errors among students struggling to divide scale intervals on the Y-axis proportionally. Some groups listed frequency values that jumped erratically based solely on the raw data found (e.g., 1, 2, 5, 8) without maintaining a consistent scale increment. These findings reinforce the argument that, while visual aids are highly beneficial, understanding mathematical scales still requires specific teacher intervention and scaffolding. Determining graph scales and axes for elementary students consistently requires teacher guidance to prevent misconceptions regarding numerical increments (Brizuela & Cayton-Hodges, 2022). Representing numerical scales on bar charts is a particularly challenging area for elementary students, necessitating intensive teacher intervention (Rahmawati & Nusantara, 2024).

D. Conclusion

Contextual learning assisted by PAMADI media regarding bar charts can be implemented through stages involving a school canteen problem scenario, collecting data on favorite foods, recording tallies, constructing frequency tables, presenting bar charts, and analyzing data. Research results indicate that students' data presentation skills reached 83.67% (categorized as "Capable"), while their data analysis skills reached 86% (categorized as "Advanced"). The overall student learning mastery rate reached 89.89%, and student activity during the lesson fell into the "Advanced" category (100%). These findings demonstrate the effectiveness of this approach in teaching students about bar charts as a form of data representation; teachers can utilize school contexts relevant to students' lives to develop more meaningful data-related instruction.

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