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Improving Mathematics Diagram Learning Outcomes of Grade 2 Students at SDN Cibilik Through the Word Wall Game Assisted by Interactive Flat Panel (IFP)

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ABSTRACT

This study aims to describe the improvement of mathematics diagram learning outcomes of Grade 2 students at SDN Cibilik through the implementation of the Word Wall game assisted by an Interactive Flat Panel (IFP). The low learning outcomes, with only 25% of students achieving the Minimum Mastery Criterion (MMC) in the pre-cycle condition, serve as the background of this research. The study employed a Classroom Action Research (CAR) method using the Kemmis and McTaggart model, conducted in two cycles. The research subjects were 12 Grade 2 students at SDN Cibilik in the even semester of the 2025/2026 academic year. Data were collected through end-of-cycle written tests and student learning activity observation sheets. The results showed significant improvements in each cycle: the class mean score increased from 60.0 in the pre-cycle to 71.6 in Cycle I and 83.6 in Cycle II. The classical mastery rate rose from 25.0% to 66.7%, and finally reached 100.0% in Cycle II, exceeding the 80% success criterion. These findings confirm the effectiveness of combining Word Wall and IFP in creating active, interactive, and visually engaging learning environments that enhance students' understanding of diagram concepts.

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Introduction

Mathematics is one of the core subjects with a strategic role in developing students' logical, analytical, and systematic thinking skills. Under the Merdeka Curriculum currently implemented in Indonesia, mathematics learning is designed to be more contextual and meaningful. One of the topics taught in Grade 2 of elementary school is diagrams, covered in Chapter 8 of the Grade 2 mathematics textbook, encompassing the ability to read, present, and interpret data in the form of simple bar charts and picture diagrams, known as pictograms (Ministry of Education, Culture, Research, and Technology, 2022).

The ability to understand diagrams is a fundamental skill students need in daily life, particularly for reading visually presented information. However, field observations indicate that the majority of lower-grade students still struggle with understanding diagram concepts. This aligns with the findings of Angriani et al. (2021), who reported that the mathematical representation ability of elementary school students remains low, particularly in data presentation. This condition is largely attributed to teacher-centred instructional approaches, insufficient use of interactive media, and the failure to optimally accommodate students' visual learning styles.

A similar condition was found in the Grade 2 class at SDN Cibilik. Based on initial observations and pre-cycle assessments, only 3 out of 12 students (25.0%) achieved the Minimum Mastery Criterion (MMC) score of 70. The class mean score was only 60.0, well below the minimum mastery target. Several contributing factors were identified: (1) lecture-dominated instruction that limited active student participation, (2) minimal use of visually engaging media to explain diagram concepts, and (3) insufficient variety in learning activities to stimulate student motivation (Supriyadi, 2020).

In response to these problems, the researcher designed a game-based learning intervention using the Word Wall platform displayed through an Interactive Flat Panel (IFP). Word Wall is an online game-based learning platform that allows teachers to design interactive activities flexibly, providing various game types such as match-up, quiz, and spin the wheel that can be customised to suit the learning material (Nurdiana & Yusuf, 2022). Meanwhile, IFP is a large-screen touch display that enables direct interaction between users and digital content, making learning more dynamic and participatory (Handayani et al., 2023).

The combination of Word Wall and IFP is believed to create an engaging learning environment for Grade 2 students aged 7–8 years. At this stage, children are still in Piaget's concrete operational stage and are highly responsive to visual stimuli and game-based activities (Piaget in Slavin, 2019). Game-based learning has been empirically shown to increase student engagement and learning motivation (Miftah & Kurniawan, 2021). To date, studies that specifically combine Word Wall with IFP for Grade 2 mathematics diagram instruction remain limited. This study therefore aims to fill that gap by describing and analysing improvements in mathematics diagram learning outcomes at SDN Cibilik through Word Wall game-based learning assisted by IFP in the even semester of the 2025/2026 academic year.

Method

Research Design

This study employed a Classroom Action Research (CAR) method using the Kemmis and McTaggart model. This model was selected for its systematic and spiral procedure, in which each cycle consists of four interrelated stages: (1) planning, (2) action, (3) observation, and (4) reflection (Kemmis, McTaggart, & Nixon, 2014). The reflection at the end of each cycle serves as the basis for the improvement plan in the

subsequent cycle, ensuring continuous enhancement of instructional quality. The study was designed to run for two cycles.

Participants and Setting

The research subjects were all 12 Grade 2 students at SDN Cibilik, comprising 5 male and 7 female students aged 7–8 years with varying academic backgrounds. The study was conducted at SDN Cibilik during the even semester of the 2025/2026 academic year, from the first week of April 2026 to the second week of May 2026.

Research Procedure

Cycle I consisted of two sessions with a time allocation of 2 × 35 minutes each. During the planning stage, the researcher prepared a lesson plan for Chapter 8 Diagram material based on the Merdeka Curriculum, integrating the Word Wall game assisted by IFP, along with observation sheets and evaluation questions. The first session focused on introducing types of diagrams using IFP displays, followed by group Word Wall gameplay. The second session deepened understanding through independent practice and concluded with a written evaluation test. Reflection of Cycle I produced several improvement recommendations applied in Cycle II: slowing the pace of scale-reading instruction, providing structured scaffolding through hint cards, increasing the variety of Word Wall game types, and ensuring each student had a direct turn to interact with the IFP screen.

Data Collection and Analysis

Data were collected through two main instruments: (1) written tests consisting of multiple-choice and short-answer questions administered at the end of each cycle, aligned with the learning competencies of Chapter 8 under the Merdeka Curriculum; and (2) student learning activity observation sheets. Students were considered to have achieved mastery upon obtaining a minimum score of 70 in accordance with the school-set MMC. Classical mastery was achieved when at least 80% of students exceeded the MMC (Mulyasa, 2020). Data were analysed using descriptive quantitative methods by calculating the class mean score and classical mastery rate for each cycle.

Results

Pre-Cycle Baseline Condition

Prior to the classroom action research, baseline data were obtained from a diagnostic mathematics diagram test administered during the first week of April 2026. Pre-cycle results showed that the class mean score was only 60.0, with a mastery rate of 25.0% (3 out of 12 students). Nine students had not yet achieved the MMC of 70. Observations revealed that instruction was dominated by lecture methods using conventional whiteboards, and students appeared unenthusiastic and struggled with pictogram interpretation questions.

Table 1. Students' Scores – Pre-Cycle

No.	Student Name	M/F	Score	Status
1	AUR	F	55	Not Passed
2	APM	F	60	Not Passed
3	DK	F	50	Not Passed
4	LP	M	65	Not Passed
5	MNS	M	45	Not Passed
6	MLN	M	70	Passed
7	MR	M	55	Not Passed
8	MRD	M	60	Not Passed
9	NA	F	75	Passed
10	SP	F	50	Not Passed
11	SZ	F	65	Not Passed
12	YH	F	70	Passed
	Average / Mastery		**60.0**	**3 of 12 Passed (25.0%)**

Cycle I Results

Cycle I intervention was carried out during the second and third weeks of April 2026. In the first session, the teacher displayed examples of bar charts and pictograms from students' daily lives via the IFP, then divided students into small groups for turn-based Word Wall gameplay. Student enthusiasm increased significantly compared to prior conventional instruction. The second session continued with independent practice and concluded with a written evaluation test.

Observation results showed that most students were enthusiastic during Word Wall gameplay. However, several challenges were noted: some students still had difficulty reading bar chart scales, group gameplay time was not evenly distributed, and some Word Wall questions were considered too easy and insufficiently challenging.

Table 2. Students' Scores – Cycle I

No.	Student Name	M/F	Score	Status
1	AUR	F	70	Passed
2	APM	F	72	Passed
3	DK	F	65	Not Passed
4	LP	M	75	Passed
5	MNS	M	60	Not Passed
6	MLN	M	78	Passed
7	MR	M	68	Not Passed
8	MRD	M	73	Passed
9	NA	F	80	Passed
10	SP	F	65	Not Passed
11	SZ	F	75	Passed
12	YH	F	78	Passed
	Average / Mastery		**71.6**	**8 of 12 Passed (66.7%)**

Cycle I evaluation results showed notable improvement. The class mean score increased to 71.6 and the mastery rate rose to 66.7% (8 out of 12 students). Nevertheless, the success criterion had not yet been fully met, as 4 students remained below mastery.

Cycle II Results

Cycle II was implemented during the first and second weeks of May 2026, incorporating improvements based on Cycle I reflection. The lesson plan was revised to include more structured scaffolding activities and a greater variety of Word Wall games, including "spin the wheel" and "balloon pop". The Word Wall questions were updated with more varied difficulty levels tailored to each student group's ability.

The implemented improvements successfully created a more conducive classroom dynamic. Students who had previously struggled with reading diagram scales began to show better understanding following the provision of hint card scaffolding. The greater variety of Word Wall games proved effective in sustaining all students' motivation throughout the learning sessions. All students actively participated in every game session, and interaction with the IFP screen was more fluent and structured compared to Cycle I.

Table 3. Students' Scores – Cycle II

No.	Student Name	M/F	Score	Status
1	AUR	F	85	Passed
2	APM	F	82	Passed
3	DK	F	80	Passed
4	LP	M	85	Passed
5	MNS	M	78	Passed
6	MLN	M	88	Passed
7	MR	M	82	Passed
8	MRD	M	84	Passed
9	NA	F	88	Passed
10	SP	F	80	Passed
11	SZ	F	85	Passed
12	YH	F	86	Passed
	Average / Mastery		**83.6**	**12 of 12 Passed (100.0%)**

Cycle II evaluation results showed highly significant improvement. The class mean score increased to 83.6 and the mastery rate reached 100.0% (12 out of 12 students). This result exceeded the 80% classical mastery success criterion, and the study was therefore declared successful.

Summary of Learning Outcome Improvement

Table 4 below summarises the learning outcome improvements from the pre-cycle through Cycle II.

Table 4. Summary of Learning Outcome Improvement Across Cycles

Aspect	Pre-Cycle	Cycle I	Cycle II
Mean Score	60.0	71.6	83.6
Students Passed	3 students	8 students	12 students
Mastery Rate	25.0%	66.7%	100.0%
Students Not Passed	9 students	4 students	0 students

Discussion

The results of this study demonstrate that the implementation of the Word Wall game assisted by IFP consistently improved mathematics diagram learning outcomes of Grade 2 students at SDN Cibilik. Improvement occurred at every stage of the research: from a mean of 60.0 in the pre-cycle, rising to 71.6 in Cycle I, and reaching 83.6 in Cycle II. The classical mastery rate similarly increased from 25.0% to 66.7% and ultimately 100.0% in Cycle II.

These findings are consistent with Rahmawati and Setiawan (2023), who found that the Word Wall platform significantly improved student learning outcomes because its gamification approach enhanced intrinsic motivation. Similarly, Kurniawan (2021) affirmed that enjoyable competition elements in educational games encourage students to engage more actively in learning. The improvement also aligns with the meta-analysis by Wardani et al. (2022), which confirmed that interactive learning media significantly improve mathematics learning outcomes in elementary school students compared to conventional instruction.

The role of the IFP as the display medium for Word Wall contributed significantly to the success of this study. The large-screen display and direct-touch capability allowed all students to simultaneously observe and interact with learning content (Handayani et al., 2023; Sari et al., 2023). This directly addresses the challenge posed by the characteristics of Grade 2 students who remain in the concrete operational stage and require strong visual stimulation in their learning process (Piaget in Slavin, 2019).

The sharper improvement observed in Cycle II compared to Cycle I demonstrates that the reflection and inter-cycle refinement process produced a tangible impact. The addition of scaffolding and the diversification of Word Wall game types successfully accommodated differences in student ability, enabling previously struggling students to ultimately achieve mastery. This finding supports Vygotsky's (in Slavin, 2019) assertion regarding the importance of the Zone of Proximal Development (ZPD) in game-based learning. Through peer interaction in Word Wall gameplay and teacher-provided scaffolding support, students were able to develop beyond their initial ability.

Overall, the combination of Word Wall and IFP created an active, interactive, and enjoyable learning environment. Gamification elements such as scores, competition, and immediate feedback have been shown neuropsychologically to enhance memory retention and conceptual understanding (Plass et al., 2020), making them highly suitable for diagram material that demands strong visual interpretation skills.

Conclusion

Based on the classroom action research conducted over two cycles, it can be concluded that the implementation of the Word Wall game assisted by Interactive Flat Panel (IFP) was effective in improving mathematics diagram learning outcomes of Grade 2 students at SDN Cibilik in the even semester of the 2025/2026 academic year. The class mean score increased from 60.0 in the pre-cycle to 71.6 in Cycle I and 83.6 in Cycle II. The classical mastery rate rose from 25.0% to 66.7%, and finally reached 100.0% in Cycle II, surpassing the 80% success criterion.

This study recommends that teachers adopt the Word Wall game assisted by IFP as an effective learning media variation, particularly for material requiring data visualisation such as diagrams. School principals are advised to support the enhancement of teachers' digital competency through training in interactive learning platforms. Future researchers may extend this study by incorporating moderating variables such as learning styles, or applying the approach to different subjects and grade levels to broaden the generalisability of the findings.

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