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Application of the Cooperative Learning Model Using the Gallery Walk Method to Improve Cognitive Learning Outcomes on the Solar System Topic

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Abstract: Natural Science is an important subject that connects scientific concepts with real-life contexts. However, students' cognitive learning outcomes at SMPN 45 Pekanbaru remain relatively low due to the application of teaching methods that are not yet optimal and unengaging learning media, particularly in the Solar System topic, which is inherently abstract. This study aims to describe students' cognitive learning outcomes and to determine the improvement in learning outcomes after the application of a cooperative learning model using the Gallery Walk strategy. This research employed a quasi-experimental design with a posttest-only control group design. The population consisted of all seventh-grade students of SMPN 45 Pekanbaru, comprising four classes with a total of 160 students. The sample was selected using simple random sampling, resulting in two homogeneous classes totalling 80 students. The instrument used was a written cognitive learning test consisting of 20 multiple-choice questions. Data were analyzed using descriptive and inferential statistical analyses. The results showed that the experimental group recorded a mean score of 81, which fell into the good category, whereas the control group showed a comparatively lower average score. Inferential analysis using the Mann–Whitney test indicated a statistically meaningful difference in students' cognitive learning outcomes between the experimental and control classes (Asymp. Sig. = 0.001 < 0.05). Therefore, the application of the Gallery Walk method has proven to be effective and feasible for improving the cognitive learning outcomes of seventh-grade students on the Solar System topic at SMPN 45 Pekanbaru. These findings suggest that the Gallery Walk method can serve as an alternative instructional strategy for science teachers to enhance students' cognitive learning outcomes, particularly on abstract topics such as the Solar System.

Keywords: Cooperative Learning; Cognitive Learning Outcomes; Gallery Walk; Solar System.

Introduction

Learning refers to an interactive process involving students, teachers, learning materials, instructional methods, strategies, and learning resources within a learning environment [1]. This process can be achieved through the creation of a conducive learning environment, which contributes to the attainment of students' maturity levels in physical, psychological, social, emotional, economic, moral, and spiritual aspects [2]. In this process, teachers play a role in providing guidance and offering various opportunities that encourage students to learn and gain experiences in accordance with the learning objectives, including in science learning.

Science is a field of research that connects school learning with everyday life. It is an integrated discipline that encompasses various fields, including physics, chemistry, and biology [3]. To research it effectively, an appropriate learning process is required to achieve the basic competencies and learning objectives. Science consists of a systematic body of theories that are generally applied to natural phenomena through scientific methods, such as observation and experimentation, while also fostering scientific attitudes, including curiosity, honesty, and openness [4].

Several factors can support the attainment of basic competencies, including the learning model, the approach used in the learning process, and supporting facilities such as classrooms, laboratories, libraries, and learning media [5]. In practice, science learning has generally been dominated by the use of the lecture method. Although various learning methods have been developed, the lecture method remains the most frequently used approach by teachers in the classroom.

Problems that frequently arise in science learning, particularly at SMPN 45 Pekanbaru, include the presentation of learning materials that are less engaging and the limited involvement of students, which result in suboptimal learning outcomes. In addition, the lack of teachers' creativity and skills in selecting and implementing appropriate learning strategies also contributes to this condition. Low student learning motivation ultimately affects the learning outcomes achieved. This condition is consistent with previous research findings which state that the application of conventional teaching methods, especially in science subjects, tends to make students passive, as indicated by their reluctance to ask questions, limited responses to teachers' questions, and participation only when directly appointed by the teacher [6].

These problems need to be addressed immediately to prevent them from persisting. One possible effort that can be made is for teachers to select and apply a learning model that can motivate students to be more active in science learning while simultaneously improving their understanding of the material. Among the various learning models available, one

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of them is the cooperative learning model. This model emphasizes group-based learning, in which students can engage in discussions, complete tasks collaboratively, help one another, and provide mutual support when dealing with problems that need to be discussed [7]. Within the cooperative learning model, there are several types, one of which is the Gallery Walk method that can be applied in science learning.

Gallery Walk originates from the English words "gallery" and "walk." The word gallery means exhibition or corridor. An exhibition is an activity aimed at introducing products, works, or ideas to the public, such as art exhibitions, writing exhibitions, and book exhibitions. Meanwhile, walk means to move or to step [8]. Thus, Gallery Walk can be interpreted as a "walking exhibition." In this activity, students display their work in the form of posters containing the results of their exploration and information gathering related to science subjects.

Gallery Walk can also encourage students to participate actively in the learning process, as it allows them to provide mutual feedback and corrections among peers, both within and between groups [9]. The advantages of this learning approach are that students can actively participate, learn from their peers, and experience a more enjoyable learning environment. This increases students' motivation, which in turn enhances their learning outcomes and engagement [10].

Based on preliminary observations and interviews with science teachers at SMPN 45 Pekanbaru, it was found that learning activities, particularly in the Solar System topic, were still dominated by verbal explanations and the use of textbooks without adequate learning media support. The media used by teachers was limited to pictures in the textbooks, resulting in students' lack of concrete visual representations of abstract concepts. The teaching methods generally used were lectures combined with question-and-answer sessions and assignments. Another problem identified was the low level of student participation in learning, as reflected by the large number of seventh-grade students who did not achieve the minimum mastery criterion (KKM). The KKM for science subjects at the school was set at 75. In 2023, out of 156 seventh-grade students, only 20 students reached the KKM, while the majority had not yet achieved mastery. This condition indicates that most students have not been able to fully comprehend the material. The low achievement level highlights the need for immediate improvement through the implementation of more effective, innovative, and engaging learning strategies.

Based on the explanation above, the cooperative learning model with the gallery walk method is important to be implemented in relation to the learning problems that occur in seventh-grade students, as this method seeks to improve students' abilities both individually and in groups. In addition, it helps enhance students' memory retention of the learning material and motivates them to be more active and engaged in the learning process.

The gallery walk method is considered suitable for increasing students' learning activity. This is in line with research that examined the implementation of the cooperative learning model using the gallery walk method in History subjects. The research showed that the application of the gallery walk method was able to enhance students' learning activity levels, which in turn had a positive impact on their learning outcomes [11]. In addition, the gallery walk learning model has been shown to significantly improve students' learning achievement [12].

Based on the explanation above, the purpose of this research is to describe students' cognitive learning outcomes through the implementation of the cooperative learning model using the gallery walk method on the topic of the solar system, as well as to determine the improvement in learning outcomes after the application of this method. The cooperative learning model with the *gallery walk* method is considered effective in enhancing students' learning activities and learning achievement.

Research Methods

This research employed a quantitative approach with a Quasi-Experimental Design, using the Posttest-Only Control Group Design, as presented in Table 1.

Table 1. Research Design of Posttest-Only Control Group Design

Class	Treatment	Post-test
Experimental	X	O_1
Control	-	O_2

Source: Sugiyono [13]

The population of this research consisted of all seventh-grade students of SMP Negeri 45 Pekanbaru, comprising four classes with a total of 160 students. The research sample was selected using a simple random sampling technique based on the results of normality and homogeneity tests of daily assessment scores prior to the Solar System topic. From these results, two homogeneous classes were obtained: class VII.1 (experimental class) and class VII.2 (control class), with a total of 80 students. The experimental class received cooperative learning treatment using the Gallery Walk method, while the control class received conventional learning. After the treatment, both classes were administered a posttest to measure cognitive learning outcomes.

The data collection instrument used in this research was a written cognitive learning test consisting of 20 multiple-choice questions on the Solar System topic. The test was developed based on the learning outcome indicators of the Merdeka Curriculum, covering cognitive domains from C1 (remembering) to C5 (evaluating). The data collection instrument used in this research was a written cognitive learning test consisting of 20 multiple-choice questions on the Solar System topic. The test was developed based on the learning outcome indicators of the Merdeka Curriculum, covering cognitive domains from C1 (remembering) to C5 (evaluating). Experts validated this instrument to ensure content validity and appropriate levels of difficulty.

The data analysis techniques used in this research were descriptive analysis and inferential analysis. The descriptive analysis technique was used to describe students' cognitive learning outcomes after the implementation of the cooperative learning model using the gallery walk method in the experimental class and conventional learning in the control class. To calculate the students' cognitive learning outcomes, Equation 1 was used.

$$\text{Score (x)} = \frac{\text{Number of correct answers}}{\text{Maximum score}} \times 100 \quad (1)$$

The analysis of the improvement in students' cognitive learning outcomes is presented in Table 2.

Table 2. Category for Assessing Students' Learning Outcomes

Value Range	Category
$0 \leq \times < 50$	less good
$51 \leq \times < 70$	good enough
$71 \leq \times < 85$	good
$86 \leq \times < 100$	very good

Source: Bely et al. [14]

Inferential analysis was used to test the hypothesis regarding the difference in students' cognitive learning outcomes between the experimental and control classes using an independent sample *t*-test at a 5% significance level. Before testing, normality was assessed using the Kolmogorov–Smirnov test, and homogeneity was tested using Levene's Test to ensure that the data met the assumptions of parametric statistics. Hypothesis testing can be conducted based on the following criteria [15]: 1) If the significance value $P \geq 0.05$, then H_0 is accepted and H_1 is rejected, 2) If the significance value $P < 0.05$, then H_0 is rejected and H_1 is accepted.

In this research, the statistical hypotheses tested were as follows: H_0: There is no significant difference in cognitive learning outcomes between the experimental class and the control class. H_1: There is a significant difference in cognitive learning outcomes between the experimental class and the control class.

Results and Discussion

The learning process was carried out over five meetings, followed by the administration of a post-test in both the experimental and control classes using a written test instrument. The purpose of the post-test was to measure students' cognitive learning achievement after the treatment was given. The test instrument consisted of 20 multiple-choice questions designed to assess cognitive domain indicators from C1 to C5. Data analysis in this research included descriptive analysis to describe students' learning outcomes in both classes and inferential analysis to test the differences in learning outcomes between them.

Descriptive Analysis Results

The post-test data were presented in the form of descriptive analysis to illustrate students' cognitive learning outcomes in both the experimental and control classes. This analysis was conducted on the topic of the Solar System at SMPN 45 Pekanbaru after the learning process was completed. The details of students' learning outcomes for each indicator are shown in Table 3.

Based on Table 3, students' cognitive learning outcomes on the Solar System material were obtained, the experimental class obtained the highest score in domain C3 (91) and the lowest in domain C5 (70), with an average score of 82 (good category). Meanwhile, the control class obtained the highest score in domain C1 (81) and the lowest in domain C5 (63), with an average score of 70 (good enough category). This proves that the cognitive learning outcomes of students in the experimental class were higher than those in the control class after implementing the cooperative learning model with the gallery walk method. Furthermore, to examine the distribution of students' cognitive learning outcomes in more detail based on score categories (Table 4).

Table 3. Analysis of Students' Cognitive Learning Outcomes for Each Indicator

Cognitive domain	Experiment Class		Control Class	
	Score	Category	Score	Category
Remembering (C1)	83	good	81	good
Understanding (C2)	83	good	64	good enough
Applying (C3)	91	Very good	80	good
Analyzing (C4)	79	good	64	good enough
Evaluating (C5)	70	good	63	good enough
Average	82		70	
Category	good		good enough	

Table 4. Frequency Distribution of Students' Cognitive Learning Outcomes

Interval	Category	Experiment Class (%)	Control Class (%)
$0 \leq \times < 50$	less good	0	4
$51 \leq \times < 70$	good enough	0	14
$71 \leq \times < 85$	good	60	13
$86 \leq \times < 100$	very good	40	9

Table 4 shows that the number of students with high learning outcomes was higher in the experimental class than in the control class. In the experimental class, 16 students (40%) achieved the very good category, and 24 students (60%) achieved the good category. Therefore, no students achieved the lower category. This shows that all students in the experimental class have achieved good and very good learning outcomes after implementing cooperative learning with the gallery walk method. While learning as usual in the control class, only 9 students (22.5%) achieved very good learning outcomes, 13 students (32.5%) obtained good category, while the rest were in the sufficient and less category, namely 18 (45%) students. This means that in the control class, there are still many students who have not achieved the expected results.

This difference shows that the number of students who achieved high learning outcomes was significantly higher in the experimental class. Thus, the implementation of the cooperative learning model using the *gallery walk* method effectively improved students' cognitive learning outcomes not only in terms of average scores but also in the number of students who achieved optimal mastery compared to conventional learning in the control class.

Inferential Analysis

The inferential analysis in this research was conducted using SPSS version 26**,** which included the normality test**,** homogeneity test, and hypothesis testing**.** Before performing the hypothesis test, prerequisite tests

were carried out using the students' daily test scores on the material taught prior to the Solar System topic. The normality test was conducted using the Kolmogorov–Smirnov test, and the results are presented in Table 5.

Table 5. Results of the Posttest Normality Test for Experimental and Control Classes

Group	Sig. Post.test
Experiment Class	0.001
Control Class	0.001

Based on Table 5, the significance values of the normality test for both the experimental and control classes were 0.001, which are smaller than 0.05, indicating that the data were not normally distributed. The homogeneity test using the Test of Homogeneity of Variances also produced a significance value of 0.001 < 0.05, meaning the data were not homogeneous. Therefore, the nonparametric Mann-Whitney test was used to test the hypothesis. The results of the Mann–Whitney test showed an Asymp. Sig. (2-tailed) value of 0.001 < 0.05, indicating that H_0 was rejected and H_1 was accepted. Thus, there was a significant difference in students' cognitive learning outcomes between the experimental and control classes, demonstrating that the gallery walk method had a positive effect on improving students' learning outcomes.

Discussion of Research Findings

Based on the research results, the average cognitive learning outcome of students in the experimental class that implemented the cooperative learning model using the gallery walk method reached 82, categorized as "good", while the control class achieved an average score of 70, categorized as fairly good. This difference indicates that the implementation of the gallery walk method had a positive effect on improving students' learning outcomes. These findings are consistent with research on the application of the cooperative learning model of the gallery walk type in History subjects. The results showed that the gallery walk method was able to increase students' learning activity, which in turn led to improved learning outcomes [7].

However, the learning outcomes in the experimental class were generally still in the good category and had not yet reached the very good category. This may be due to several factors, such as the implementation of the method not being fully optimal and still requiring more intensive practice, students' characteristics not being entirely accustomed to active learning, and the Solar System material being partly abstract, thus requiring further in-depth understanding. This condition indicates that the gallery walk method is effective in improving students' cognitive learning outcomes; however, its implementation still needs to be optimized to achieve higher-level performance.

The students' cognitive learning scores in both the experimental and control classes showed differences across each C1–C5 indicator, with the details as follows:

Remembering (C1)

The remembering dimension (C1) is the most basic cognitive domain in the revised Bloom's taxonomy. This ability encompasses students' skills in recognizing and recalling information or concepts that have been previously learned [16]. In this research, the cognitive questions in the C1 domain consisted of five items designed to measure students' ability to recall factual information related to the Solar System material. The items included in this category were numbers 1, 2, 9, 14, and 19. A comparison of students' cognitive learning achievement in both classes can be seen in Figure 1.

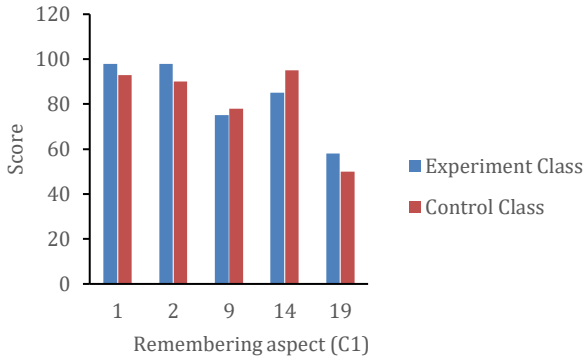

Figure 1. Graph of Students' Cognitive Learning Achievement in the Cognitive Domain of C1

Based on Table 3, student learning achievements in domain C1 (remembering) show almost the same average score, namely the experimental class with a score of 83 and the control class with a score of 81, which is categorized as good. This shows that C1's cognitive abilities in the two classes are comparable. In the experimental class that implemented the cooperative learning model with the gallery walk method, students not only received explanations from the teacher but also actively engaged in group discussions, wrote down their thoughts, and moved from one group to another to observe and provide feedback on their peers' work. These activities helped students strengthen their memory through repeated exposure to information in various contexts, such as reading, discussing, and listening to others' opinions. This meaningful repetition in the learning process strengthened students' retention of the concepts they had learned.

However, for certain questions, such as numbers 1, 9, and 14, the control class achieved slightly higher scores than the experimental class. This is because these questions required the ability to recall factual information that had often been repeated by the teacher in conventional learning, such as the names of celestial bodies and the effects of Earth's rotation on natural phenomena. Students in the control class were accustomed to receiving information directly and memorizing it, enabling them to answer factual questions quickly. In contrast, students in the experimental class were more involved in discussion and concept exploration activities, so their learning focus was more on understanding and applying concepts rather than merely remembering facts.

Thus, although the results in the remembering aspect appeared balanced between the two classes, the gallery walk method provided a more active and meaningful learning experience. Students in the experimental class not only memorized but also understood and recalled concepts through social interaction, visual activities, and group collaboration. This type of learning process not only

strengthens short-term memory but also helps students retain understanding in the long term. These findings are consistent with research showing that the cooperative learning model of the gallery walk type significantly improves students' intellectual skills and retention. The increase in the average post-test score from 60.8 to 80 indicates that the interactive activities in this method effectively enhance students' memory and understanding [17].

Understanding (C2)

The cognitive ability in the understanding domain refers to students' capacity to process the information they have obtained, such as explaining, interpreting, and comparing the material. This means that students not only recall information but also comprehend its meaning and can relate it to other relevant situations or concepts [18].

In this research, the cognitive questions in the understanding (C2) domain consisted of nine items. Based on Table 3, students' cognitive learning outcomes in the understanding aspect showed that the experimental class achieved an average score of 83, categorized as good, while the control class only reached 64, categorized as good enough.

The comparison graph of students' achievement in the experimental and control classes for each question at the understanding level can be seen in Figure 2.

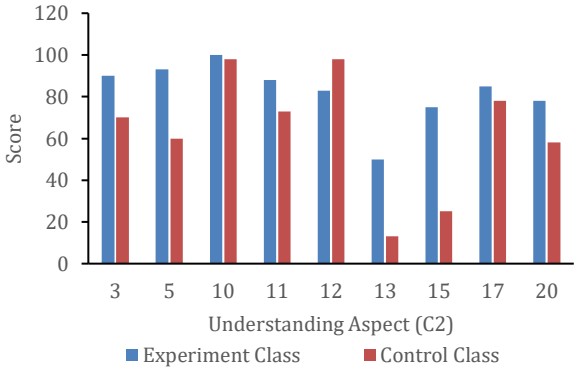

Figure 2. Graph of Students' Cognitive Learning Achievement in the Cognitive Domain of C2

Students' cognitive learning outcomes in the understanding (C2) aspect show that the experimental class achieved better results compared to the control class. This difference reflects the positive influence of implementing the cooperative learning model with the gallery walk method on students' conceptual understanding. Active student involvement during learning was a key factor in enhancing concept comprehension in the experimental class. During the gallery walk activities, students not only read and listened to the teacher's explanations but also analyzed the contents of the worksheets (LKPD), discussed their answers with group members, and sought additional information from the science textbook or other sources to complete their understanding before creating their posters. This process required each student to fully comprehend the material before presenting it visually.

Furthermore, moving around to observe other groups' work encouraged students to compare their work with that of other groups, identify similarities and differences in concepts, and reflect on their understanding. This activity strengthened students' comprehension because they were exposed to multiple perspectives from their peers, not just a single source. Students who had already understood the concepts assisted those who had not, creating a *peer teaching* process that deepened collective understanding.

The higher achievement in the experimental class compared to the control class was also influenced by intensive social interaction. The cooperative learning model requires students to share tasks, listen, and respect others' opinions, so that each member feels responsible for the group's outcomes. This two-way communication process helps students develop a stronger conceptual understanding, rather than merely memorizing information.

In contrast, learning in the control class was conducted conventionally and teacher-centered. Students mostly listened to explanations without engaging in collaborative activities or concept exploration. As a result, they tended to be passive and focused mainly on memorizing material from the textbook. Consequently, the understanding of students in the control class was limited to factual knowledge and simple definitions, rather than deep conceptual comprehension.

However, for question number 12, the control class achieved a higher score than the experimental class. This occurred because the material on natural and artificial satellites had been previously taught using a memorization approach, making it easier for students in the control class to answer the question. In contrast, students in the experimental class focused more on discussion and concept exploration activities, so for questions requiring direct definitions or simple memorization, the control class tended to perform better.

Thus, the implementation of the gallery walk method has been proven to help students understand the material more deeply by emphasizing active involvement, discussion, and concept visualization. Learning is not only focused on the final result but also on the thinking process and student collaboration, which encourages the development of meaningful understanding. These findings are consistent with research showing that the implementation of the gallery walk method significantly improved students' conceptual understanding of the sensory system material [19]. Similarly, it has been found that the gallery walk method, particularly when combined with visual media based on local potential, is effective in significantly enhancing students' conceptual understanding [20]. Both studies affirm that active and visually-based learning can help students understand and relate information more deeply.

Applying (C3)

In this research, there were two test items that measured indicators in the applying aspect, namely questions 4 and 16. Question number 4 assessed students' ability to identify the positions of planets based on the images provided, while question number 16 measured their ability to arrange the phases of the Moon according to its orbital cycle.

Based on Table 3, the cognitive learning outcomes of students in the applying aspect showed that the experimental class obtained an average score of 91 (categorized as very good), whereas the control class only achieved an average

score of 80 (categorized as good). The comparison of students' performance in this aspect can be seen in Figure 3.

Based on Figure 3, it can be seen that the students' ability in the applying (C3) domain in the experimental class is higher than that of the control class. This difference indicates that the implementation of the cooperative learning model using the gallery walk method has a positive effect on improving students' ability to apply the concepts they have learned.

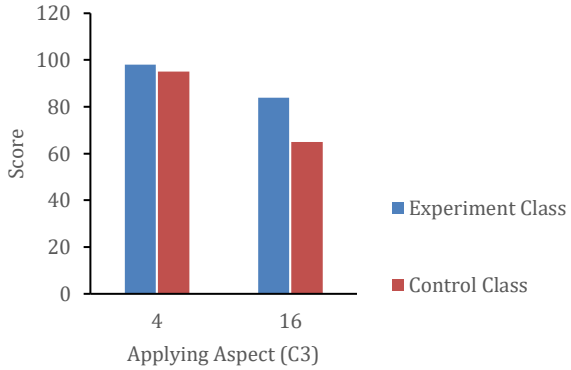

Figure 3. Graph of Students' Cognitive Learning Achievement in the Cognitive Domain of C3

This improvement occurs because, in the gallery walk method, students are actively involved in the learning process through discussion, task sharing, and group presentations. While working collaboratively, students practice applying concepts in new situations, such as identifying the positions of planets or arranging the phases of the moon based on their observations. These activities require students not only to understand theoretical knowledge but also to apply it contextually, thereby strengthening their ability to use and transfer learned concepts effectively.

Furthermore, the activity of moving from one group's work to another (gallery walk) encourages students to compare, observe, and critically evaluate the work of their peers. This process broadens students' perspectives and enhances their applied thinking skills, as they learn from various viewpoints and approaches presented by their classmates. This is in contrast to the learning process in the control class, which is more teacher-centered, where students tend to passively receive explanations without opportunities to actively apply the concepts learned. As a result, their understanding remains at the levels of remembering and understanding, rather than progressing to application.

Overall, students' cognitive learning outcomes in the applying (C3) domain show that the experimental class achieved higher results, categorized as very good, while the control class was in the good category. This indicates that students in the experimental class demonstrated a stronger ability to apply the concepts they had learned compared to those in the control class. These findings are consistent with previous research, which revealed that the gallery walk method encourages students not only to understand but also to apply knowledge through active and collaborative learning activities such as group work and discussion that reinforce both comprehension and concept implementation in the learning process [21].

Analyzing (C4)

The cognitive skill in the analyzing domain reflects students' ability to break down a problem or object into smaller components and to understand the relationships among these parts. In the context of learning about the solar system, this aspect assesses students' ability to differentiate, compare, and connect various related concepts or natural phenomena.

The cognitive learning test included several items that measured analytical skills, specifically items 6, 7, and 8. In item number 6, students were asked to analyze the characteristics of comets based on their physical features. In item number 7, they analyzed the characteristics of a planet shown in an image, while item number 8 required them to analyze planetary traits based on the descriptions provided.

A comparative graph of students' performance in the experimental and control classes for each analytical question is presented in Figure 4.

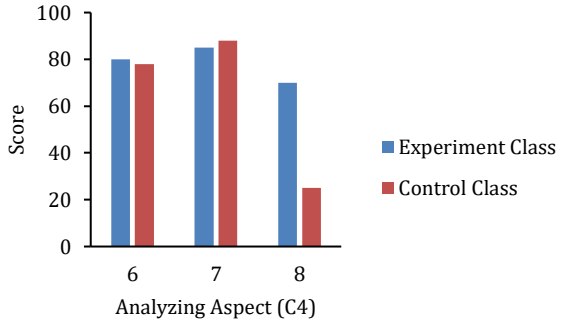

Figure 4. Graph of Students' Cognitive Learning Achievement in the Cognitive Domain of C4

Based on Table 3, the students' cognitive learning outcomes in the analyzing (C4) aspect show that the experimental class obtained an average score of 79, which falls into the good category, while the control class only achieved an average score of 64, categorized as good enough. This indicates that the cooperative learning model using the gallery walk method is more effective in developing students' analytical skills compared to conventional learning.

Analytical skills require students to break down information into essential parts, connect concepts, and draw conclusions based on observed data or phenomena. In the gallery walk activity, students are actively engaged in this process. While working in groups, they discuss the contents of the worksheet (LKPD), examine the relationships between concepts, and record the results of their analysis in the form of a poster. This process encourages each group member to think critically, filter information, and restate it in their own words. As they move around to observe other groups' work, students also compare and evaluate the information obtained, thereby further strengthening their analytical abilities.

The gallery walk method encourages two-way discussions and peer feedback that help students improve their thinking skills and strengthen their arguments. For example, when observing posters created by other groups, students may discover new perspectives they had not previously considered, which they then discuss further within their own groups. This process enables students not

only to receive knowledge but also to evaluate, connect, and reconstruct concepts independently.

In contrast, students in the control class who were taught using conventional methods tended to receive information directly from the teacher without engaging much in exploration or exchange of ideas. This condition hindered the optimal development of their analytical thinking skills, as they mainly followed the teacher's explanations and took notes without conducting an in-depth analysis of the relationships between concepts.

In question number 7, the control class obtained slightly higher results than the experimental class. This is because the question required recalling the order of the planets and the number of their satellites, which is more closely related to factual knowledge and memorization. The topic had often been discussed in previous conventional learning sessions, allowing the control class students to answer more easily. Meanwhile, students in the experimental class were more focused on discussion activities and concept analysis that demanded deeper understanding, so they performed slightly lower on factual questions of this kind.

Thus, the implementation of the gallery walk method has been proven to train students to think more critically and analytically. Group discussions, idea exchanges, and reflection activities during the gallery walk provide opportunities for students to evaluate and interpret information more deeply. These findings are consistent with previous research, which demonstrated that the application of the gallery walk method can enhance students' critical and analytical thinking skills. Learning activities that involve active participation and group interaction in the gallery walk help students develop the ability to analyze information in depth [22].

Evaluating (C5)

The ability to evaluate refers to students' skills in making judgments based on specific criteria and standards, such as quality, effectiveness, efficiency, and consistency [23]. In this research, the test item that measures evaluating ability is item number 18. The comparison graph of students' achievement between the experimental and control classes for this aspect is shown in Table 3.

The analysis results indicate that students' evaluating skills in the experimental class were higher than those in the control class. This improvement is attributed to the implementation of the gallery walk method, which requires students to think critically when assessing, comparing, and providing feedback on other groups' work. During this activity, students are not merely passive listeners; they actively observe other groups' posters, examine the clarity and accuracy of the presented concepts, and offer comments or suggestions for improvement. Such processes train students' critical and evaluative thinking skills in assessing content accuracy, conceptual correctness, and the quality of information presentation.

Furthermore, the reflection session following the gallery walk provides students with the opportunity to reassess their group's work based on feedback from peers and the teacher's guidance. This activity helps students develop their evaluative skills by making judgments about information according to specific criteria. Students learn to distinguish facts from opinions and to construct logical reasoning when providing responses or making decisions.

Meanwhile, in the control class that used conventional teaching methods, evaluative activities occurred less frequently because the learning process was more teacher-centered. Students merely received explanations without opportunities to provide feedback or assess others' work. As a result, their critical and reflective thinking skills developed more slowly compared to those in the experimental class.

Thus, the implementation of the gallery walk method provides students with opportunities to develop higher-order thinking skills through activities such as evaluating, comparing, and reasoning about a concept or piece of work. This finding is consistent with previous research, which stated that the cooperative learning model of the gallery walk type can enhance students' intellectual abilities, including the skills to analyze and distinguish between facts and opinions, which are integral components of higher-order thinking skills such as evaluation [13].

Descriptively, the posttest results indicate that the experimental class achieved an average score of 82, categorized as good, while the control class obtained an average score of only 70, categorized as good enough. This finding demonstrates that the implementation of the gallery walk method is more effective in enhancing the cognitive learning outcomes of seventh-grade students on the solar system topic compared to conventional learning. This result is supported by previous findings, which revealed that the gallery walk method significantly improved students' cognitive abilities, with the average score increasing from 60.8 to 80 [13]. Furthermore, previous research found that the application of this method had a very strong influence on students' cognitive learning outcomes in junior high schools, confirming that the gallery walk is effective not only in increasing student engagement but also in improving academic achievement [24]. The implementation of cooperative learning with the gallery walk method in grade 7 of SMP 45 Pekanbaru was able to improve cognitive learning outcomes in domains C1 to C5, as demonstrated by the learning outcomes analyzed. Students enthusiastically participated in the activity, where each group produced a poster about the solar system and presented it to the class, as shown in Figure 5.

Figure 5. Learning Activities Using The Gallery Walk Method

The Gallery Walk method is highly suitable for teaching the Solar System material because it contains many abstract concepts that require visualization and active student

engagement. Through the creation of posters, visual presentations, and group discussions, students can transform abstract astronomical concepts into more concrete and easily understandable ideas. Furthermore, the discussion stages and inter-group interactions in the Gallery Walk method help students construct conceptual understanding collaboratively, thereby enhancing both student engagement and learning outcomes [25].

Inferentially, the results of the normality and homogeneity tests showed that the data were not normally distributed and not homogeneous (sig. 0.001 < 0.05). Therefore, hypothesis testing was conducted using the non-parametric Mann–Whitney test. The results of the Mann–Whitney test revealed a significance value of 0.001 (< 0.05), indicating that H_0 was rejected and H_a was accepted. Thus, there is a significant difference between the cognitive learning outcomes of students taught using the cooperative learning model with the gallery walk method and those taught using conventional learning on the topic of the solar system.

Based on descriptive and inferential data analysis, the average cognitive learning outcomes of the experimental class were higher than those of the control class, and significant differences were found between the two. Therefore, the application of the cooperative learning model with the gallery walk method is considered appropriate and suitable for use in physics learning on the solar system material in seventh-grade junior high school, to improve students' cognitive learning outcomes. However, the effectiveness of this method will be more optimal if supported by reinforcement at each stage of implementation, especially during group discussions and gallery walk activities, which tend to require quite a long time. Efficient time management is needed to ensure that each group has sufficient opportunity to participate in class discussions, create posters, conduct observations, and provide feedback without feeling rushed. In addition, teachers are advised to prepare the learning carefully, link the material to real-life contexts, and design overall learning outcome evaluation questions to support the achievement of learning objectives comprehensively.

Conclusion

Based on the research conducted at SMPN 45 Pekanbaru by applying a cooperative learning model using the gallery walk method, it was found that the students' cognitive learning outcomes on the topic of the solar system were higher and categorized as good in the class that implemented this model compared to the class that used conventional learning. The students' learning outcomes across cognitive domains C1 to C5 also showed better achievements in the experimental class, with the highest performance observed in the C3 (Applying) domain, which was categorized as very good. Furthermore, there was a statistically significant difference in cognitive learning outcomes between the class that used the cooperative learning model with the gallery walk method and the class that used conventional instruction. Therefore, it can be concluded that the application of the cooperative learning model through the gallery walk method is effective in improving the cognitive learning outcomes of seventh-grade students on the topic of the solar system at SMPN 45 Pekanbaru.

Practically, the results of this study suggest that science teachers are encouraged to apply the gallery walk method as an alternative learning strategy, particularly for abstract topics such as the solar system. Schools are also advised to support teachers by providing adequate learning resources and allocating sufficient time for collaborative and discussion-based activities to optimize the implementation of this method.

Author's Contribution

A. Nadila: collect data and compile the article. M. Rahmad: responsible person and article compiler. Z. Ma'ruf: Assists in compiling articles.

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