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The Implementation of Problem-Based Learning to Improve Science Learning Outcomes of Students at SMPN 12 Konawe Selatan

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Abstract – This Classroom Action Research was motivated by the low scores in science subjects, which impacted students' learning outcomes. The purpose of this research is to improve science learning outcomes. The study employed the Problem Based Learning model conducted over three cycles. Data collection techniques included tests and non-tests, using data collection tools such as observation sheets for student activities, teacher activities, and final tests for each cycle. The collected data were analyzed descriptively. Based on the research findings and data analysis, it was shown that there was an improvement in students' learning outcomes. The percentage of learning completeness in Cycle I was 72.00%, which increased to 75.00% in Cycle II and 82.00% in Cycle III. This research proves that the Problem Based Learning model can improve the science learning outcomes of Class VII E students at SMP Negeri 12 Konawe Selatan.

Keywords: Science Learning Outcomes, Problem Based Learning, Classroom Action Research

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Introduction

Improving the quality of education is a primary objective of development in the education sector. Efforts to enhance educational quality are an integral part of improving the quality of Indonesian human resources, including aspects of ability, personality, and a sense of responsibility as citizens. This is in accordance with Law No. 20 of 2003. The purpose of education is to provide guidance or direction for teachers in selecting and determining teaching methods or in creating learning environments for students.

Twenty-first-century education is expected to produce young generations who possess life skills so that they are able to survive and compete in the global community. The required life skills include the ability to think critically, communicate effectively and efficiently, develop technology, and work flexibly, productively, innovatively, and responsibly.

However, these goals are not yet aligned with the quality of education in Indonesia. It must be acknowledged that the quality of education in our country remains low. Our educational quality is still below the average of other developing countries. According to UNESCO data in the Global Education Monitoring (GEM) Report 2016, the quality of education in Indonesia ranks 10th out of 14 developing countries. Meanwhile, the quality of teachers as an essential component of education ranks 14th out of 14 developing countries worldwide. In fact, 75% of schools in Indonesia do not meet the minimum standards of educational services.

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The low achievement in science learning indicates that there are aspects of science instruction in schools that have not been optimized. This can be seen in classroom learning processes that still view learning as a transfer of knowledge from teachers to students, resulting in passive learners (Dahlan, 2004: 6). This condition makes students hesitant to ask questions related to learning materials and ultimately lowers their self-confidence. In such situations, students tend to remain silent because all information related to the subject matter is obtained instantly from the teacher. Essentially, teacher-centered learning positions students merely as spectators.

The 2013 Curriculum emphasizes understanding, skills, and character education. Students are required to comprehend learning materials, actively participate in discussions and presentations, and demonstrate good manners and high discipline. This curriculum applies a scientific approach that focuses on discovering fundamental concepts underlying instructional models by instilling scientific attitudes in students, encompassing three domains: attitudes, knowledge, and skills, in line with the assessment system of the 2013 Curriculum. Learning processes are fundamentally aimed at developing students' skills, activities, and creativity through various interactions and learning experiences.

Learning can be conducted by presenting real, direct, and relevant problems that match students' needs, enabling them to obtain relevant information for each specific problem. This approach provides opportunities for students to engage in simple exploration so that they do not merely receive and memorize information (Adiga & Sachinanda, 2015).

Based on observations and interviews conducted by the researcher with a Grade VII science teacher at SMP Negeri 12 Konawe Selatan, the results of the first semester examination for Grade VII students in the 2019/2020 academic year showed that several students still scored below the Minimum Mastery Criteria (KKM) of 73. This was due to students' initial perception that science material is difficult to understand, along with the broad scope of content that must be covered within a limited time. These difficulties can negatively affect students' understanding of various concepts related to the classification of living organisms.

In relation to the above issues, innovation in science learning models that actively involve students through group collaboration is needed. One learning model that can be applied is Problem Based Learning (PBL). The PBL model emphasizes full student engagement in discovering learning materials and connecting them to real-life situations. Problem-based learning encourages students to construct their own knowledge, develop higher-order thinking skills, foster independence, and enhance self-confidence (Nur, 2011). Suharta (2013) states that the use of the PBL model during learning activities enables students to think more rather than memorize, understand lessons better through discussion, accept the learning model, improve

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learning outcomes in chemistry, promote democracy in effective learning, and develop creativity. The PBL model has several advantages, including: (1) increasing student activity in the learning process, and (2) providing opportunities for students to apply their knowledge to real-world situations (Wasonowati et al., 2014).

From its characteristics, PBL is one of the alternative instructional models suitable for developing critical thinking in science learning. PBL uses real-world problems as a context for students to learn critical thinking skills, problem-solving skills, and to acquire knowledge about the essence of learning materials (Duch in Nurkholis, 2013). The effectiveness of PBL lies in making students more active in thinking and understanding science problems collaboratively through investigation, resulting in deeper impressions and more meaningful learning experiences regarding the problems studied.

Research Methods

The type of research used was Classroom Action Research (CAR), which aimed to improve science learning outcomes on the topic of Classification of Living Organisms among Grade VII E students at SMP Negeri 12 Konawe Selatan in the 2021/2022 academic year through the implementation of the Problem-Based Learning (PBL) instructional model. The research was conducted during the odd semester, from 2 July to 14 August 2021. The research design employed an action research model in the form of cycles. This study was carried out in three cycles, with each cycle consisting of planning, implementation, observation, and reflection.

The research instruments used included observation sheets of student activities and observation sheets of teacher performance during instruction. The data analysis techniques in this study were divided into two types: quantitative data analysis, in the form of numerical data representing students' learning outcomes, and qualitative data analysis, in the form of descriptive statements illustrating the observers' observations of the implemented learning process. Quantitative techniques were used to analyze data obtained from test results in each cycle. The calculation of each student's score was conducted by summing the total scores and then calculating the class average. After obtaining individual student scores, the overall percentage of students' achievement was calculated using Equation (1) as follows.

$$N\% = \frac{NK}{R}(100\%)$$

Explanation :

N% : percentage score
NK : cumulative score
R : number of respondents

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The qualitative analysis used in this study was descriptive analysis. Suharsimi Arikunto (2006: 212) states that descriptive analysis is an analysis that functions to describe the variables being studied. In this research, descriptive analysis was intended to describe the results of observations on the implementation of science learning on the topic of inheritance of traits using the Problem-Based Learning (PBL) model, as well as students' responses to the learning activities that had been carried out.

Result and Discussion

A. Results

Results of Cycle I

Based on the observations of Cycle I conducted on 2 July 2021, it was found that students showed a positive response in positioning themselves according to the predetermined group assignments. In addition, students demonstrated fairly good performance in presenting data obtained from observations or investigations. However, in other activities, students' responses were still lacking. These included low responsiveness to the apperception provided by the teacher, limited participation in formulating problems, low engagement in data collection through practicum activities, minimal participation in asking or answering questions during other groups' presentations, and insufficient ability to draw conclusions from the material studied.

An overview of the observation results regarding student activity during the learning process in Cycle I is presented in Table 1 below.

Table 1. Percentage of Student Activity Achievement in the Learning Process in Cycle I

No	Activities	Frequency	Percentage (%)
1	Students responded to the apperception provided by the teacher	15	60
2	Students actively formulated problems	14	56
3	Students positioned themselves according to the predetermined group assignments	20	80
4	Students collected data through practicum activities	15	60
5	Students presented data from observations/investigations	18	72
6	Students actively asked and answered questions during other groups' presentations	14	56
7	Students drew conclusions from the material learned that day	15	60

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The analysis of students' science learning outcomes in the instructional process was obtained based on students' achievement in each cycle. Furthermore, the follow-up stage included the results of the daily test in Cycle I, as presented in Table 2 below.

Table 2. Specification of Students' Daily Test Scores in Cycle I

Specification	Cycle I
Number of students	25
Ideal Score	100
Maximum score	90
Minimum score	50
Average score	76
Mastery learning	72%

Table 3. Percentage of Students' Learning Mastery in Cycle I

Score Interval	Category	Frequency	Percentage (%)
≥ 73	Mastery	18	72
< 73	Not Mastery	7	28

Table 4. Percentage Distribution of Students' Learning Outcomes in Cycle I

Score Interval	Frequency	Grade	Percentage (%)
86-100	2	A (Excellent)	8
71-85	16	B (Good)	64
56-70	5	C (Fair)	20
< 56	2	D (Poor)	8

From the tables, it can be seen that 18 students achieved mastery, with a mastery percentage of 72%, while 7 students did not achieve mastery, with a percentage of 28%. The mastery learning criterion of 73% (KKM) had not yet been achieved. This was due to students' limited responsiveness to the apperception provided by the teacher, low participation in formulating problems, insufficient engagement in data collection through practicum activities, limited participation in asking or answering questions during other groups' presentations, and inadequate ability to draw conclusions from the material learned that day.

Results of Cycle II

Based on the observations of Cycle II conducted on 16 July 2021, it was found that students showed an increase in learning activities, including improved responsiveness to the apperception provided by the teacher, fairly active participation in formulating problems, very good ability to

e-ISSN : 3124–6796
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position themselves according to the predetermined group assignments, and fairly active involvement in data collection through practicum activities. In addition, students demonstrated good performance in presenting data from observations or investigations and were able to draw appropriate conclusions from the material learned. However, in other activities, students' responses were still lacking, particularly in actively asking and answering questions during other groups' presentations.

An overview of the observation results regarding student activity during the learning process in Cycle II is presented in Table 5 below.

Table 5. Percentage of Student Activity Achievement in the Learning Process in Cycle II

No	Activities	Frequency	Percentage (%)
1	Students responded to the apperception provided by the teacher	9	75
2	Students actively formulated problems	8	67
3	Students positioned themselves according to the predetermined group assignments	11	92
4	Students collected data through practicum activities	9	75
5	Students presented data from observations/investigations	10	83
6	Students actively asked and answered questions during other groups' presentations	7	58
7	Students drew conclusions from the material learned that day	10	83

The analysis of students' science learning outcomes in the instructional process was obtained based on students' achievement in each cycle. Furthermore, the follow-up stage included the results of the daily test in Cycle II, as presented in the table below.

Table 6. Specification of Students' Daily Test Scores in Cycle II

Specification	Cycle II
Number of students	12
Ideal Score	100
Maximum score	90
Minimum score	50
Average score	77.5
Mastery learning	75%

e-ISSN : 3124–6796
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Table 7. Percentage of Students' Learning Mastery in Cycle II

Score Interval	Category	Frequency	Percentage (%)
≥ 73	Mastery	9	75
< 73	Not Mastery	3	25

Table 8. Percentage Distribution of Students' Learning Outcomes in Cycle II

Score Interval	Frequency	Grade	Percentage (%)
86-100	4	A (Excellent)	33
71-85	5	B (Good)	42
56-70	1	C (Fair)	8
< 56	2	D (Poor)	17

From the table, it can be seen that 9 students achieved mastery, with a mastery percentage of 75%, while 3 students did not achieve mastery, with a percentage of 25%. The achievement of 75% mastery learning, which meets the Minimum Mastery Criteria (KKM), was attributed to increased student activities, including improved responsiveness to the apperception provided by the teacher, fairly active participation in formulating problems, very good ability to position themselves according to the predetermined group assignments, fairly active involvement in data collection through practicum activities, as well as good performance in presenting data from observations or investigations and the ability to draw appropriate conclusions from the material learned. These improvements contributed to the enhancement of students' learning outcomes.

Results of Cycle III

Based on the observations of Cycle III conducted on 2 August 2021, it was found that students showed improvements in all learning activities, including responsiveness to the apperception provided by the teacher, fairly active participation in formulating problems, very good ability to position themselves according to the predetermined group assignments, fairly active involvement in data collection through practicum activities, good performance in presenting data from observations or investigations, and the ability to draw appropriate conclusions from the material learned. In addition, students were active in asking and answering questions during other groups' presentations.

An overview of the observation results regarding student activity during the learning process in Cycle III is presented in the table below.

e-ISSN : 3124–6796
Doi : doi.org/sampel-number-xxxx

Table 9. Percentage of Student Activity Achievement in the Learning Process in Cycle III

No	Activities	Frequency	Percentage (%)
1	Students responded to the apperception provided by the teacher	10	83
2	Students actively formulated problems	9	75
3	Students positioned themselves according to the predetermined group assignments	11	92
4	Students collected data through practicum activities	10	83
5	Students presented data from observations/investigations	11	92
6	Students actively asked and answered questions during other groups' presentations	10	83
7	Students drew conclusions from the material learned that day	11	92

The analysis of students' science learning outcomes in the instructional process was obtained based on students' achievement in each cycle. Furthermore, the follow-up stage included the results of the daily test in Cycle III, as presented in the table below.

Table 10. Specification of Students' Daily Test Scores in Cycle III

Specification	Cycle III
Number of students	11
Ideal Score	100
Maximum score	90
Minimum score	50
Average score	79
Mastery learning	82%

Table 11. Percentage of Students' Learning Mastery in Cycle III

Score Interval	Category	Frequency	Percentage (%)
≥ 73	Mastery	9	82
< 73	Not Mastery	2	18

Table 12. Percentage Distribution of Students' Learning Outcomes in Cycle III

Score Interval	Frequency	Grade	Percentage (%)
86-100	4	A (Excellent)	45
71-85	4	B (Good)	33

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56-70	1	C (Fair)	8
< 56	1	D (Poor)	88

From the table, it can be seen that 9 students achieved mastery, with a mastery percentage of 82%, while 2 students did not achieve mastery, with a percentage of 18%. The achievement of 82% mastery learning, exceeding the Minimum Mastery Criteria (KKM), was due to improvements in all learning activities. These included increased responsiveness to the apperception provided by the teacher, fairly active participation in formulating problems, very good ability to position themselves according to the predetermined group assignments, fairly active involvement in data collection through practicum activities, good performance in presenting data from observations or investigations, the ability to draw appropriate conclusions from the material learned, and active participation in asking and answering questions during other groups' presentations.

B. Discussion

This study is a form of Classroom Action Research that refers to the Problem-Based Learning (PBL) model, which is an instructional model designed to solve presented problems. According to Arends (2008: 41), PBL is a learning model that presents students with various authentic and meaningful problem situations that can serve as a starting point for investigation and inquiry. PBL helps students develop critical thinking skills and problem-solving skills. Therefore, the researcher sought to identify more innovative methods and media so that students would feel motivated and be able to understand the taught material more quickly, thereby increasing their learning interest and enabling their learning outcomes to reach the predetermined Minimum Mastery Criteria.

Marsigit (2013: 1–2) states that PBL begins with the assumption that learning is an active, collaborative, integrated, and constructive process influenced by social and contextual factors. PBL is also characterized by a student-centered approach, the teacher acting as a facilitator, and the use of open-ended or ill-structured problems as initial stimuli for learning. Open-ended problems are those that have multiple possible solutions; therefore, students must examine various methods before deciding on a particular answer. Ill-structured problems encourage students to conduct investigations, engage in discussions, and gain experience in problem solving. In addition to emphasizing learning by doing, PBL makes students aware of what information they already possess regarding the problem, what information is needed to solve it, and what strategies should be used to facilitate problem solving. Articulating these thoughts helps students become more effective problem solvers and more self-directed learners.

Amir (in Nurkholis, 2013) states that problem-based learning has ten main characteristics: 1) Problems serve as the starting point for learning; 2) The problems presented are real-world, ill-structured problems; 3) Problems require multiple perspectives; 4) Problems challenge students'

e-ISSN : 3124–6796
Doi : doi.org/sampel-number-xxxx

attitudes and competencies; 5) Self-directed learning is a primary focus; 6) The use of diverse resources and evaluation is an essential process in PBL; 7) Learning is collaborative, communicative, and cooperative; 8) The development of inquiry and problem-solving skills is as important as mastery of content knowledge; 9) Synthesis and integration are part of the learning process; 10) PBL involves evaluation and review of learning experiences and processes. In general, it can be concluded that there was an increase in students' learning activities when the PBL model was implemented in Cycles I, II, and III. This indicates that the PBL instructional model has a positive effect on students' ability to respond to the apperception provided by the teacher, actively formulate problems, appropriately position themselves according to predetermined group assignments, actively collect data through practicum activities, effectively present observation or investigation results, draw conclusions from the material learned, and actively ask and answer questions during other groups' presentations.

The achievement of student activities in the learning process during Cycle I, particularly for indicators in the preliminary activities, revealed that some students did not respond to the apperception provided by the teacher, with an achievement percentage of 60%. This was caused by the teacher's inability to provide apperception that effectively attracted students' interest and motivation, as reflected in the facts and data obtained during the learning process. In practice, the teacher delivered apperception in a non-contextual manner, making it less engaging for students. Additionally, several students were found to be less actively involved in formulating problems, with an achievement percentage of 56%. This was due to the problem orientation being presented by the teacher only visually in the form of images on PowerPoint slides, as indicated by the observed data during the learning activities.

Some students were less actively involved in the field practicum, with an achievement percentage of 60%, resulting in suboptimal observation data. This was caused by the teacher not providing maximum guidance to students, either individually or in groups. Students were also less active in analyzing and evaluating the problem-solving process, with an achievement percentage of 56%. This occurred because the teacher had not yet developed adequate questioning skills to stimulate students to actively ask and answer questions during discussions. In the closing activity, it was found that students still experienced difficulties in drawing conclusions from the material learned, with an achievement percentage of 60%. This was due to the teacher's inability to optimally guide students in learning how to formulate conclusions. These findings indicate that during the learning process in Cycle I, several indicators of student activity were still very low, including students' responsiveness to the apperception provided by the teacher, active participation in formulating problems, engagement in data collection through practicum activities, participation in asking and answering questions during other groups'

e-ISSN : 3124–6796
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presentations, and the ability to draw conclusions from the material learned. Therefore, the implementation of the Problem-Based Learning (PBL) model needed to be optimized in Cycle II.

Based on the observation results, it was found that 18 students achieved mastery, with a mastery percentage of 72%, while 7 students did not achieve mastery, with a percentage of 28%. The mastery learning criterion of 73% (KKM) had not yet been achieved due to students' limited responsiveness to the apperception provided by the teacher, low participation in formulating problems, insufficient engagement in data collection through practicum activities, limited participation in asking and answering questions during other groups' presentations, and inadequate ability to draw conclusions from the material learned that day.

The achievement of student activities in the learning process during Cycle II showed that students demonstrated increased activity, including responsiveness to the apperception provided by the teacher, with an achievement percentage of 75%. This improvement occurred because, during the apperception stage, the teacher brought live plant media and artificial plants to orient students to the learning activity, thereby attracting students' interest and motivation to learn. Furthermore, the activity of formulating problems showed an increase to 67%, as the teacher was better able to orient students to the problem by presenting more relevant audiovisual media. Students demonstrated very good ability to position themselves according to the predetermined group assignments, with an achievement percentage of 92%, indicating that students were able to organize themselves within groups in an orderly manner.

In addition, students were fairly active in collecting data through practicum activities, with an achievement percentage of 75%. Data collection conducted in the schoolyard was carried out in an orderly and effective manner, creating a conducive learning environment. Students also showed good performance in presenting observation or investigation results, with an achievement percentage of 83%, demonstrating confidence in communicating their findings to other groups. Furthermore, students were able to draw conclusions from the material learned, with an achievement percentage of 83%, as students and the teacher collaboratively summarized the lesson content. However, in other activities, students' responses were still lacking, particularly in asking and answering questions during other groups' presentations, with an achievement percentage of 58%. This was because students had not yet developed adequate questioning skills, limiting their ability to collaborate optimally with peers and actively engage in discussions. These findings indicate that in Cycle II, although student activity indicators had improved, some had not yet reached the expected level, necessitating further optimization of the PBL model in Cycle III.

Based on observation results, it was found that 9 students achieved mastery, with a mastery percentage of 75%, while 3 students did not achieve mastery, with a percentage of 25%. The achievement of 75% mastery learning, in accordance with the KKM, was due to increased student activities, including improved responsiveness to the apperception provided by the teacher, fairly

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active participation in formulating problems, very good organization according to predetermined group assignments, fairly active involvement in data collection through practicum activities, effective presentation of observation or investigation results, and the ability to draw conclusions from the material learned, all of which contributed to improved learning outcomes.

The achievement of student activities in the learning process during Cycle III showed further improvement. Students demonstrated increased responsiveness to the apperception provided by the teacher, with an achievement percentage of 83%. This improvement occurred because, during the apperception stage, the teacher used audiovisual media to orient students to the learning activity, thereby increasing their interest and motivation to learn. The activity of formulating problems also showed an increase to 75%, as the teacher was able to better orient students to the problem by presenting more relevant audiovisual media. Students demonstrated very good ability to position themselves according to predetermined group assignments, with an achievement percentage of 92%, indicating highly orderly group organization.

Furthermore, students were active in collecting data through practicum activities, with an achievement percentage of 83%. Students actively observed the plants under study and subsequently constructed determination keys and dichotomous keys. Students also demonstrated good performance in presenting observation or investigation results, with an achievement percentage of 83%, showing confidence in communicating their findings to other groups. Finally, students were very capable of drawing conclusions from the material learned, with an achievement percentage of 92%, as students and the teacher collaboratively summarized the lesson content.

Students demonstrated a very significant improvement in activity, particularly in asking and answering questions during other groups' presentations, with an achievement percentage of 93%. This improvement occurred because students had developed good questioning skills, enabling them to collaborate effectively with their peers and actively participate in discussions and question-and-answer sessions. This indicates that, in Cycle III, all observed indicators of student activity experienced optimal improvement as expected, and therefore the learning process using the Problem-Based Learning (PBL) model was successfully optimized in this cycle.

From the table, it can be seen that 9 students achieved mastery, with a mastery percentage of 82%, while 2 students did not achieve mastery, with a percentage of 18%. The achievement of 82% mastery learning, exceeding the Minimum Mastery Criteria (KKM), was due to improvements across all learning activities. These included increased responsiveness to the apperception provided by the teacher, fairly active participation in formulating problems, very good ability to position themselves according to predetermined group assignments, fairly active involvement in data collection through practicum activities, effective presentation of observation

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or investigation results, the ability to draw appropriate conclusions from the material learned, and active participation in asking and answering questions during other groups' presentations.

Pradnyana (2013) states that problem-based learning is an instructional approach in which students are presented with problems that are contextualized within their real-life environment, thereby providing meaningful experiences that can be used as learning material to develop understanding and serve as guidance and learning objectives for optimally improving academic achievement.

Based on the research findings and discussion, the implementation of the PBL model was shown to increase students' learning outcomes, with mastery percentages of 72% in Cycle I, 75% in Cycle II, and 82% in Cycle III. These improvements were attributed to enhancements in all learning activities, including responsiveness to the apperception provided by the teacher, active problem formulation, effective group organization, active data collection through practicum activities, clear presentation of observation or investigation results, the ability to draw conclusions from the material learned, and active engagement in asking and answering questions during other groups' presentations.

Conclusion

In general, it can be concluded that there was an increase in students' learning activities when the Problem-Based Learning (PBL) model was implemented in Cycles I, II, and III. This indicates that the PBL instructional model has a positive effect on students' ability to respond to the apperception provided by the teacher, actively formulate problems, effectively position themselves according to predetermined group assignments, actively collect data through practicum activities, present observation or investigation results effectively, draw conclusions from the material learned, and actively ask and answer questions during other groups' presentations.

Based on the research findings and discussion, the implementation of the PBL model was proven to increase students' learning outcomes, with mastery percentages of 72% in Cycle I, 75% in Cycle II, and 82% in Cycle III. These improvements were due to enhancements across all learning activities, including responsiveness to the teacher's apperception, active problem formulation, effective group organization, active data collection through practicum activities, effective presentation of observation or investigation results, the ability to draw conclusions from the material learned, and active engagement in asking and answering questions during other groups' presentations.

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