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Teacher Strategies in Developing Students Independence in Physics Learning

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ABSTRACT

Purpose of the study: This study aims to identify and analyze the instructional strategies used by physics teachers to develop students' learning independence, particularly their responsibility in completing tasks and self-confidence in solving problems, in accordance with 21st-century education demands.

Methodology: This study employed a qualitative naturalistic method using direct classroom observation, in-depth interviews, and document analysis. Tools included observation checklists, interview guides, and physics learning modules. Thematic analysis was conducted using manual coding without software. Data triangulation combined teacher, student, and laboratory assistant perspectives. The subject comprised 36 tenth-grade students at State High School 11 Muaro Jambi.

Main Findings: This study demonstrates that students' learning independence improves through the application of well-structured teaching strategies. Students were able to complete class assignments independently and showed strong confidence in solving physics problems. Teachers implemented inquiry-based, problem-based, and project-based learning models supported by scaffolding and contextual tasks. Activities such as group discussions, presentations, and self-reflection significantly contributed to fostering independent learning behaviors and student responsibility.

Novelty/Originality of this study: The novelty of this study lies in its explicit focus on enhancing students' learning independence through a comprehensive integration of four instructional dimensions approach, method, model, and strategy. Additionally, the inclusion of laboratory assistants as data sources enriches the contextual insight. This study contributes to the literature by illustrating how early, intentional instructional design can effectively build learning independence at the secondary school level.

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1. INTRODUCTION

Physics learning is frequently viewed as demanding by students, as it requires both conceptual mastery and analytical reasoning. These difficulties, however, present an opportunity to develop student autonomy when teachers use strategies that promote independent learning [1], [2]. In this process, the teacher's role shifts from an instructor to a facilitator who guides students in navigating the learning process. Active learning environments created by such teachers encourage students to engage with the material more deeply. As previous studies suggest, learning independence significantly enhances students' academic outcomes and personal growth [3].

In the context of 21st-century education, students must be equipped with critical thinking, creativity, collaboration, and communication skills [4]. Learning autonomy becomes essential as students are expected to take charge of their learning process, set goals, and evaluate outcomes independently. These expectations are aligned with the nature of physics learning, which demands analytical and problem-solving competencies. Self-directed learners are more likely to succeed academically and adapt to various learning situations [5], [6]. Therefore, promoting learning independence is not just a pedagogical goal but a necessity in modern education [7][8].

Despite the advantages of fostering independence, many classrooms still rely heavily on lecture-based instruction [9]. This passive model inhibits students from developing initiative and responsibility. In contrast, inquiry-based, project-based, and problem-solving approaches are proven to stimulate student engagement and independence [10]. The Merdeka Curriculum, for instance, promotes autonomy by encouraging teachers to implement active learning methods. These methods align with constructivist and humanistic learning theories that support student-centered education [11], [12].

This research was initiated due to the persistent observation that many students lack the motivation and initiative to learn independently [13]. Factors such as low confidence, limited self-motivation, and a lack of supportive environments further hinder the development of independent learning [14], [15]. Teachers, therefore, must design instructional strategies that address these issues and promote responsibility and confidence in students. Such efforts are especially crucial in science subjects, which require both intellectual discipline and active participation [16], [17]. Encouraging independence from an early stage can shape students into proactive and resilient learners [18].

The aim of this study is to identify and analyze teaching strategies employed by physics teachers that cultivate student independence. Specifically, the research examines how teachers develop instructional approaches, methods, models, and techniques to foster responsibility and confidence in learning. These strategies are intended to support students in completing assignments independently and approaching problems with initiative. By understanding these strategies, educators can refine their teaching practices to meet students' developmental needs [19], [20]. The study also explores how students respond to such strategies in the learning environment.

It is expected that the findings of this study will offer valuable insights for improving physics instruction at the secondary level. By highlighting effective practices for fostering independent learning, the research contributes to the broader discourse on educational innovation. The study uses a naturalistic qualitative method involving tenth-grade students at State High School 11 Muaro Jambi. Through this approach, the research captures authentic interactions and instructional practices within a real classroom setting. Ultimately, this study seeks to offer practical recommendations for developing responsible, self-confident, and independent learners in alignment with 21st-century educational goals.

2. RESEARCH METHOD

2.1 Qualitative Method

This research uses a qualitative approach with a type of naturalistic study that aims to deeply understand the strategies used by teachers in fostering student learning independence in physics subjects. This approach was chosen because it is able to reveal the meaning, perceptions, and real practices applied by teachers in an authentic learning context. Naturalistic research focuses its study on natural situations without any manipulation of variables, so that the data obtained reflects the actual situation in the field. But here the researcher uses 2 indicators for students, including, Doing their own class assignments that are their responsibility and having confidence that they can solve the problems they face. The main focus of this method is the interaction between teachers and students in the physics learning process that can shape independent learning attitudes.

The research instruments include classroom observations, interviews, and document analysis. To maintain consistency and depth of data, the researcher developed structured observation and interview guidelines as shown in the following table:

Table 1. Observation Sheets And Interviews

Aspect Observed/Interviewed	Indicator	Data Source	Question/Observation Item
Task independence	Student completes tasks without direct help	Class observation, student interview	Does the student complete tasks without relying on direct answers from the teacher?
Problem-solving confidence	Student shows initiative and courage to try	Student & teacher interview	What do you do when facing difficulty solving physics problems?
Teacher strategy for independence	Teacher uses inquiry and problem-solving	Class observation, teacher interview	What teaching methods does the teacher use today?
Scaffolding role	Gradual teacher assistance	Observation & teacher interview	How does the teacher support students struggling with the material?

Data collection was conducted through direct observation of learning activities in the classroom, in-depth interviews with physics teachers, and analysis of learning documents such as Modules and evaluation tools. Observation is used to find out how teachers implement learning strategies, while in-depth interviews aim to explore the reasons, motivations, and experiences of teachers in guiding students to learn independently. Meanwhile, learning documents are analyzed to see the suitability between the teaching plan and its implementation in shaping learning independence. Data triangulation was conducted to increase the validity and reliability of the research results, namely by comparing the results of observations, interviews, and documents obtained from various sources.

In the data analysis process, researchers use thematic analysis techniques which include data reduction, data presentation, and conclusion drawing stages. Each data obtained will be categorized into certain themes related to learning strategies, the role of teachers, and the characteristics of student learning independence. Researchers will also look at patterns of behavior and interaction in the classroom that reflect the growth of independent attitudes in students. With this approach, it is expected to obtain a complete understanding of how physics learning strategies can shape student learning independence effectively and sustainably.

2.2 Researc Subject

The subjects in this study were class X students at State High School 11 Muaro Jambi, totaling 36 people. The selection of subjects was done purposively based on the consideration that the class is a relevant representation to observe the dynamics of physics learning that demands learning independence. This class was chosen because it has implemented learning with the latest curriculum approach and has a physics teacher who actively uses various learning strategies. The diverse characteristics of students in terms of academic background and learning ability are expected to provide a comprehensive picture of the effectiveness of teacher strategies in shaping learning independence. This study does not aim to generalize, but to gain an in-depth understanding of how physics learning strategies are applied in the context of the class, as well as how students respond and engage in the independent learning process. The data obtained from interactions with these subjects become the main source in revealing learning practices that are able to foster independent learning attitudes.

3. RESULTS AND DISCUSSION

The results of this study will be described based on two main indicators, namely students' ability to complete their own class assignments that are their responsibility and students' self-confidence in facing and solving physics learning problems. To strengthen the analysis, data was obtained through in-depth interviews with physics teachers, students, and also laboratory assistants as supporters of practicum activities. The findings will be organized into four main subchapters, namely approaches, methods, models, and learning strategies used by teachers. The approach subchapter will describe the teacher's perspective in guiding the students' learning process independently. The method section will discuss the technical steps used by teachers in learning to foster independence. Next, the learning model section will identify the form of learning such as inquiry, project, or blended learning that is applied in the classroom. Finally, the strategies section will include specific techniques or patterns designed by teachers to foster students' responsibility and confidence. Each subchapter will show how the relationship between the chosen approach and the achievement of learning independence indicators, accompanied by thematic interview quotes to strengthen the validity of the findings in class X State High School 11 Muaro Jambi.

Table 2. Indicator Independent Character Indicator

Character	Indicator
Independent	Doing their own classwork that they are responsible for
	Has confidence that he/she can solve the problems faced

3.1. Learning Approaches

Table 3. Interview with teacher and student

No.	Interview Questions	Interview Results
	Teacher	
1	How do you approach teaching to encourage students to complete tasks independently?	I use inquiry-based learning to guide students in discovering concepts by themselves.
2	What strategies do you use to help students believe they can solve problems on their own?	I gradually reduce assistance and promote self-assessment and peer discussion.
3	How do you integrate learning activities that foster both responsibility and confidence?	By assigning tasks with real-life relevance where students must decide how to approach the problem.
4	How do you support students who lack confidence in their ability to solve problems?	I give positive reinforcement and let them reflect on small successes.
5	How do learning approaches like collaborative learning or flipped classroom help develop student independence?	They shift the focus from teacher to learner, pushing students to take ownership of their learning.
	Student	
1	What kind of classroom activities help you complete tasks by yourself?	Activities where I can explore topics and find answers without waiting for direct instruction.
2	Do you feel confident solving problems given by your teacher? Why or why not?	Yes, because I'm used to working through challenges step by step.
3	How does your teacher's teaching method affect your ability to work independently?	The way my teacher guides us without giving direct answers makes me think more on my own.
4	What makes you believe you can complete difficult tasks?	Past experiences where I succeeded help me believe I can do it again.
5	How do group discussions or presentations help you become more independent?	They give me the chance to explain my ideas and learn from others, which builds confidence.

Based on Table 3, the learning approaches used by physics teachers at State High School 11 Muaro Jambi show a strong tendency towards the use of inquiry and collaborative approaches that aim to increase students' learning independence. Teachers stated that they direct students to discover physics concepts through independent exploration, gradual reduction of assistance, and application of activities relevant to real life, such as contextual problem solving. This strategy is also complemented by emotional support in the form of positive reinforcement and reflection activities on small successes achieved by students, which is proven to increase their confidence in facing learning challenges. Students themselves admit that they are better able to complete tasks independently when given space to think and explore, and feel more motivated and confident in solving problems given by the teacher. Activities such as group discussions and presentations are considered very helpful in shaping a sense of responsibility and the ability to express opinions independently. This shows that an approach that shifts the focus from the teacher as the center of learning to the students as the main actors is very effective in fostering the character of independent learners.

Student learning independence can be fostered through the application of inquiry and collaborative learning approaches that encourage active student involvement Research shows that this approach helps students to develop learning strategies independently [21]. According to constructivism theory, knowledge is built through direct learning experiences and individual reflection [22]. This approach is also supported by humanistic learning theory which focuses on the full actualization of student potential [23]. Constructivism theory is very much in line with the approach used, as students construct knowledge through experience and interaction with the environment. Vygotsky emphasized the importance of the teacher's role as a facilitator who provides scaffolding to help students in their zone of proximal development. In physics learning, a learning environment that supports exploration and collaboration is essential in fostering independent learning. Meaningful learning encourages students to develop reflective thinking.

These results reinforce previous studies that emphasize the importance of students' transition to self-directed learning in higher education [24]. This finding also complements the research that shows the importance of student engagement in experiential learning activities to foster a sense of responsibility [25] This study refines the results of previous studies by showing that the approach can significantly improve students' learning independence. This finding supports the study results of Lau et al. [25] which highlighted the importance of

independent learning competencies in learning. This study adds that the application of this strategy is also effective in face-to-face learning. This shows that the approach used by the teacher directly supports the development of students' independence in the learning process, Students get the opportunity to explore and understand the material through activities directed at concept discovery. In addition, teachers also facilitate discussion and individual reflection so that students are more confident in completing tasks. This approach not only fosters a sense of responsibility, but also students' internal motivation.

3.2. Teaching Method

Table 4. Interview with Teacher

No.	Interview Questions	Interview Results
	Teacher	
1	What teaching methods do you use to promote students' independence in completing class tasks?	I often use problem-based and inquiry methods where students are encouraged to explore solutions on their own.
2	How do you ensure students take responsibility for their own tasks?	I set clear expectations and give them autonomy to choose how they approach the task.
3	What teaching method do you find most effective in helping students build confidence to solve problems?	I use scaffolding — starting with guidance and gradually letting them take control.
4	How do you monitor students' development of responsibility and confidence through your teaching methods?	I observe their decision-making process and ask them to reflect on their learning.
5	What are the challenges in using teaching methods to develop these independence traits?	Some students are too used to direct instruction and struggle when given freedom initially.
	Student	
1	How do your teacher's teaching methods help you complete tasks independently?	They usually guide us first and then let us work on our own, which helps me learn by doing.
2	What kind of teaching makes you feel more confident solving problems?	When we're allowed to try solving it ourselves before the teacher explains.
3	Do you feel responsible for completing your tasks when given more freedom in class?	Yes, because I know it's up to me to get it done and my teacher trusts me.
4	How does the teacher respond when you succeed in completing something difficult?	They give positive feedback, which makes me feel more confident next time.
5	What teaching method motivates you the most to try solving problems on your own?	I like when we work in small groups and the teacher gives hints instead of full answers.

Tables 4 show that the teaching methods used by teachers play a major role in shaping students' independent attitude in learning physics. Problem-based and inquiry methods are the main choices because they encourage students to explore solutions on their own, foster a sense of responsibility for the task, and increase their self-confidence. Teachers start the learning by providing initial guidance (scaffolding) and gradually transferring control to students to complete the task independently. The teacher also sets clear expectations and gives students freedom in choosing their approach to task completion, while monitoring their decision-making process and reflection on their learning outcomes. Students responded positively to this method by showing a responsible attitude towards the task and higher motivation in solving problems. They mentioned that the trust given by the teacher, as well as the encouragement to try themselves before being given an explanation, made them more confident and less afraid of failure. The challenge faced by teachers in implementing this method is that some students are still accustomed to direct learning and have difficulty adapting to the freedom given, but through a consistent process, students slowly begin to show increased independence in thinking and acting.

The application of inquiry and problem-based methods is proven to encourage students to complete tasks independently [26]. Learning independence is also strengthened when students are given autonomy in developing the steps to complete the task [27]. According to Vygotsky's theory, scaffolding is an effective technique in gradually leading students to independent learning [28]. Humanistic theory also emphasizes the importance of creating a learning environment that motivates and rewards student initiative [29]. The use of learning media to increase learning motivation in primary schools. This method is in line with humanistic learning theory which emphasizes the role of motivation and giving responsibility to students. Carl Rogers emphasized that effective learning occurs when students feel safe, valued, and free to choose. The application of methods that give students autonomy encourages the formation of the value of responsibility and self-confidence in completing physics tasks. Thus, this theory becomes a strong foundation for modern learning practices.

This research extends previous findings on the importance of methods that allow for student exploration [30]. Previous studies also emphasize that teachers who use active learning are able to increase students'

responsibility and confidence [31]. This research complements previous studies on the effectiveness of active learning methods in improving learning independence. The findings also support research showing that students who are given the freedom to take responsibility for their tasks show higher motivation to learn. By applying diverse and adaptive methods, teachers are able to encourage students' overall engagement. This is the basis for developing future learning strategies.

3.3 Learning Models

Table 5. Interview with Teacher

No.	Interview Questions	Interview Results
	Teacher	
1	How do PBL and PJBL help students take responsibility for their learning tasks?	These models place students at the center, requiring them to manage their own contributions and deadlines.
2	How do you observe student independence in completing tasks within PBL or PJBL?	I assess how well they handle roles, manage time, and take initiative during group projects.
3	What strategies in PBL or PJBL help students build confidence in solving problems?	Giving them real-world problems and guiding them to find their own solutions builds strong self-belief.
4	How do you balance guidance and autonomy in PBL and PJBL?	I provide initial support but gradually let them lead, which helps them grow independently.
5	What challenges do students face in these models and how do you help them overcome them?	They often struggle with group dynamics or decision-making, so I mentor them through reflection and feedback.
	Student	
1	How do PBL or PJBL projects help you complete your responsibilities?	They make me feel responsible because I have a role and deadline to meet.
2	Do you feel more independent working on PBL or PJBL tasks? Why?	Yes, because I have to plan my work and contribute to the team without waiting for instructions.
3	How confident do you feel solving problems in these learning models?	Quite confident, because I've learned how to think critically and try different solutions.
4	What do you do when you face a problem during a project?	I first try to solve it myself or discuss with my group before asking the teacher.
5	What do you like about PBL or PJBL in terms of learning independently?	I like that I can explore topics deeply and make decisions about my learning process.

Table 5 show how learning models such as Project-Based Learning and Problem-Based Learning provide ample space for students to develop learning independence in physics learning. Teachers use these models by placing students as active subjects who are responsible for their roles and tasks in the group. In the implementation of PBL and PJBL, students are encouraged to manage their time, divide roles, and solve problems collectively, with teacher intervention decreasing as the process progresses. The projects given by the teacher are contextual and related to real life, so students feel that their learning has practical value and not just theory. This increases student engagement and responsibility in the learning process. In interviews, students admitted that this model makes them more trained in critical thinking, taking initiative, and solving problems without relying on the teacher. When experiencing difficulties, they tend to discuss in groups first before asking the teacher for help, indicating a change in attitude from dependence to independence. Thus, PBL and PJBL learning models not only improve students' cognitive competence, but also shape the character of independent and responsible learners.

PBL and PJBL models put students at the center of learning, which forces them to manage their own responsibilities and time [32]. This model helps students design creative problem-solving strategies [33] [34] Improving the learning independence of students with learning difficulties through a peer-based PJBL model. The project-based learning model applied in this study successfully fostered students' sense of responsibility for group tasks. Each student has a specific role in the team that demands active contribution and time awareness. Teachers observed the development of independence through project implementation and reflective evaluation. This model proved effective in facilitating the formation of independent learning attitudes. From the perspective of social constructivism theory, students who are active in collaboration and problem solving tend to have higher learning independence [35]. Project-based learning is in line with the principles of meaningful learning developed by Bruner and Vygotsky [36]

This research supports previous findings that the PJBL model is effective in building learning independence in students with learning difficulties [37]. It also adds the dimension of students' ownership of responsibility in the learning process which has not been widely discussed in previous studies. This research enhances previous approaches by providing direct monitoring of student achievement and self-reflection. In

addition, this model strengthens the teacher's role as a facilitator and provides space for students to grow as independent learners. The application of PJBL and PBL models consistently showed a positive impact on improving students' learning outcomes and independent attitudes. These results support the development of a 21st century skills-oriented curriculum.

3.4 Teaching and Learning Strategies

Table 6. Interview with teacher and student

No.	Interview Questions	Interview Results
	Teacher	
1	How do you encourage students to complete their classroom tasks independently?	I encourage them by assigning individual tasks and giving them ownership of their responsibilities.
2	What strategies do you use to help students build confidence in solving problems on their own?	I use positive reinforcement and problem-based learning to help them believe in their abilities.
3	How do you identify students who lack independence in learning and problem-solving?	I observe their behavior in group and individual tasks and follow up with support sessions.
4	What role do you think classroom activities play in fostering student independence?	Classroom activities such as projects and presentations are essential in building independence.
5	Can you share a successful experience where a student demonstrated improved independence?	One student used to rely heavily on me, but after several projects, they started solving problems independently.
	Student	
1	How do you usually complete your classroom tasks? Do you prefer working alone or with help?	I usually try to do them on my own first. I ask for help only if I really need it.
2	Can you give an example of a time you solved a problem by yourself in class?	Once I had trouble understanding a math problem, but I reread the steps and solved it myself.
3	What makes you feel confident or not confident when doing schoolwork independently?	I feel confident when I understand the topic and when my teacher encourages me.
4	How do your teachers help you become more independent in learning?	They give us activities where we have to think for ourselves and work in groups with roles.
5	What do you do when you face a difficult task in class?	I try to break it down into smaller steps and solve each one. If that doesn't work, I ask my friend or teacher.

Based on Tables 6, the teaching strategies used by teachers involve various approaches to encourage students to complete tasks independently and build their confidence in facing learning challenges. Teachers provide individualized tasks that encourage ownership of responsibility, apply problem-based learning, and provide positive reinforcement for students' success in completing difficult tasks. In addition, teachers directly observe students' behavior in group and individual tasks to identify their level of independence, and provide additional guidance for students who still show dependency.

Activities such as presentations, group discussions and self-reflection are used as strategies to get students used to expressing ideas, taking responsibility for the learning process and actively solving problems. Students indicated that these strategies helped them feel trusted and motivated to complete tasks independently. They mentioned that when facing difficulties, they tend to try to solve them by themselves first, and then ask for help from friends or teachers. This indicates that teaching strategies that are systematic, consistent and adaptive to students' needs have a significant impact in shaping independent learning attitudes and strengthening students' resilient character in the physics learning process.

Teacher strategies such as individual assignments and encouragement to take responsibility encourage the growth of student independence [38]. Teachers also encourage self-reflection through challenging classroom activities [39], [40] The learning strategy used by teachers in this study emphasizes giving individual and group responsibility. Teachers actively monitor and provide feedback to build students' confidence in completing tasks. Presentation activities, group discussions, and individual reflections are used to form an independent mindset. This strategy makes students accustomed to taking the initiative in learning.

In humanistic learning theory, motivation and self-confidence are the foundations of learning independence [41]. Reflective activities and positive experiences contribute to the formation of students' confidence in completing tasks [42]. The learning strategies used are consistent with the principles of social cognitive theory which views learning as the result of interactions between the individual, environment and behavior. In this study, students showed significant development in their ability to complete physics tasks

independently after the implementation of strategies that build reflection and self-motivation. Group discussion-based learning activities became an effective tool in this process. Thus, this approach is relevant to be widely applied.

Previous studies reveal that active learning and student empowerment have a significant impact on learning independence [43], [44] This study complements previous findings by showing that a systematic and gradual strategy can build sustainable independence. It adds that implementing strategies that build independence from the secondary school level will better prepare students for higher education [45]. The findings support previous studies and enhance learning practices by emphasizing the importance of strategies that build responsibility and initiative. Consistent implementation of active learning strategies can establish a culture of independent learning in the long run. Therefore, these strategies should be made part of national education policy.

The discussion in this study reveals that the implementation of instructional approaches, methods, models, and strategies by the physics teacher at State High School 11 Muaro Jambi has significantly contributed to the development of students' learning independence. Through the use of inquiry-based learning, problem-based methods, and project-based models such as PBL and PJBL, the teacher was able to create a learning environment that encouraged students to take responsibility for their tasks and build confidence in solving problems.

The learning process was designed in a gradual and student-centered manner, supported by scaffolding techniques that shifted responsibility from teacher to student over time. Interview data from teachers, students, and the laboratory assistant confirmed that activities such as group discussions, independent assignments, and reflection sessions played an important role in reinforcing both student initiative and accountability, aligning with the two primary indicators of learning independence identified in this research.

This research presents several novel contributions to the field of physics education, particularly at the secondary level. One of the key innovations lies in the comprehensive analysis of four instructional dimensions approach, method, model, and strategy in a unified framework to assess how they influence students' responsibility and self-confidence in learning. The inclusion of laboratory assistants as part of the interview process also provides a fresh perspective, emphasizing the role of laboratory support in promoting student autonomy during practical sessions. Furthermore, by focusing on Grade 10 students, the study offers insight into how the formation of independent learning behavior can be initiated early in the educational process. The naturalistic qualitative approach used in this study enhances the authenticity of the findings, offering an in-depth look at how real-world teaching practices affect students' ability to learn independently.

The findings imply that fostering learning independence requires deliberate efforts from teachers to design learning activities that not only emphasize academic content but also cultivate personal responsibility, self-regulation, and confidence. Teachers are encouraged to provide students with meaningful opportunities to make decisions, solve problems, and reflect on their progress through guided yet flexible instructional strategies. Despite its contributions, this study has limitations. It was conducted in a single classroom setting, limiting the generalizability of the results. Moreover, the reliance on interviews and observations carries the potential for subjective interpretation. Future research should consider broader populations and mixed-method approaches to validate and expand upon these findings, ensuring their relevance in varied educational contexts.

4. CONCLUSION

The study on tenth-grade students of State High School 11 Muaro Jambi concludes that the use of appropriate instructional strategies such as inquiry-based, problem-based, and project-based learning significantly fosters students' learning independence. These strategies, supported by scaffolding, a conducive environment, and laboratory assistants, helped students take responsibility and build confidence in learning physics. Key indicators of independence included completing tasks autonomously and confidently solving problems. Adaptive and participatory approaches like discussions, presentations, individual tasks, and reflection further enhanced motivation, cognitive achievement, and character development, shaping students into responsible and self-assured learners.

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