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Improving Students' Biology Learning Outcomes Through the Implementation of a Guided Inquiry Model

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Abstract: This study aims to improve the biology learning outcomes of 10th-grade students at Madrasah Aliyah Miftahul Ulum Bettet Pamekasan, Madura, by implementing the guided inquiry model. This classroom action research was conducted during the odd semester of the 2023-2024 academic year, involving 40 students as subjects. Data collection was carried out using pre-tests and post-tests for each Cycle to measure learning outcomes. The results indicated that applying the guided inquiry model could enhance students' biology learning outcomes. In the first Cycle, the average learning score was 78, with a completion rate of 65%. Following adjustments and improvements, the second Cycle saw an increase in the average learning score to 85, with a completion rate of 90%. These findings suggest that the guided inquiry model can be an effective alternative in biology teaching to improve students' learning outcomes at Madrasah Aliyah. The implications of this study provide a basis for developing more interactive and participatory teaching methods.

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Introduction

In modern education, improving learning quality is necessary to adapt to the evolving landscape of science and technology (Bhat, 2023). Biology, as a branch of natural science, plays a pivotal role in understanding basic concepts of life supporting students in building analytical and critical thinking skills (Susilawati & Muhfahroyin, 2021). However, a common challenge that arises is the low biology learning outcomes among students, potentially due to teaching methods that fail to engage students in the learning process actively (Sari et al., 2023; Herman et al., 2021; Pratiwi et al., 2021). One teaching model suggested to improve student learning outcomes is guided inquiry (Kusasi & Istyadji, 2023; Baidi, 2022; Hakim et al., 2020). Guided inquiry is a strategy identified by education researchers as an effective method to increase student engagement and comprehension of study materials (MACHPUD, 2022; Jannah et al., 2020; Kewere et al., 2020). This model encourages students to explore study materials independently while still within a framework controlled by the teacher, facilitating active and in-depth learning (Bramastia & Trisnawati, 2023; Muhadi et al., 2022).

Previous studies have demonstrated that applying the inquiry model in science education can enhance students' conceptual understanding and critical thinking skills (Antonio & Prudente, 2024). The guided inquiry model offers students an opportunity to interact more intensively with the study material through questions designed to guide them in

the process of scientific discovery (Almira et al., 2023). Other studies suggest that guided inquiry is more effective than fully unstructured exploratory learning because it provides the necessary support to address difficulties in understanding complex concepts (Gillies, 2023; Twizeyimana et al., 2024). However, limited research still examines its impact in the context of Madrasah Aliyah education, especially in biology.

Observations of teaching at Madrasah Aliyah Miftahul Ulum Bettet Pamekasan, Madura, revealed that students' academic achievements did not meet the established criteria. During the learning process, students tended to struggle with understanding concepts, particularly in biotechnology. Additionally, the instructor seldom used engaging teaching methods during the teaching process and relied primarily on rote memorization. This resulted in low student engagement in the learning process and a lack of motivation. These observations suggest the need to address students' learning challenges by implementing teaching models that actively engage them, one of which is guided inquiry (Ziliwu, 2020). This study aims to improve biology learning outcomes for students through the implementation of the guided inquiry model at Madrasah Aliyah Miftahul Ulum Bettet Pamekasan in the 2023 academic year.

Research Methods

This study is classroom action research (CAR) conducted during the first semester of the 2023-2024 academic year in Class X of Madrasah Aliyah Miftahul Ulum Bettet Pamekasan, Madura. The subjects of this research were 40 female students from Class X in the first semester of the 2023-2024 academic year. This study aimed to determine the biology learning outcomes by implementing a guided inquiry model during the teaching process. The instructional tools used in this research included a learning goal sequence (ATP) and a teaching module. The learning outcome data were collected through pre-tests and post-tests administered at the end of each Cycle. The data analysis technique employed in this research was descriptive analysis.

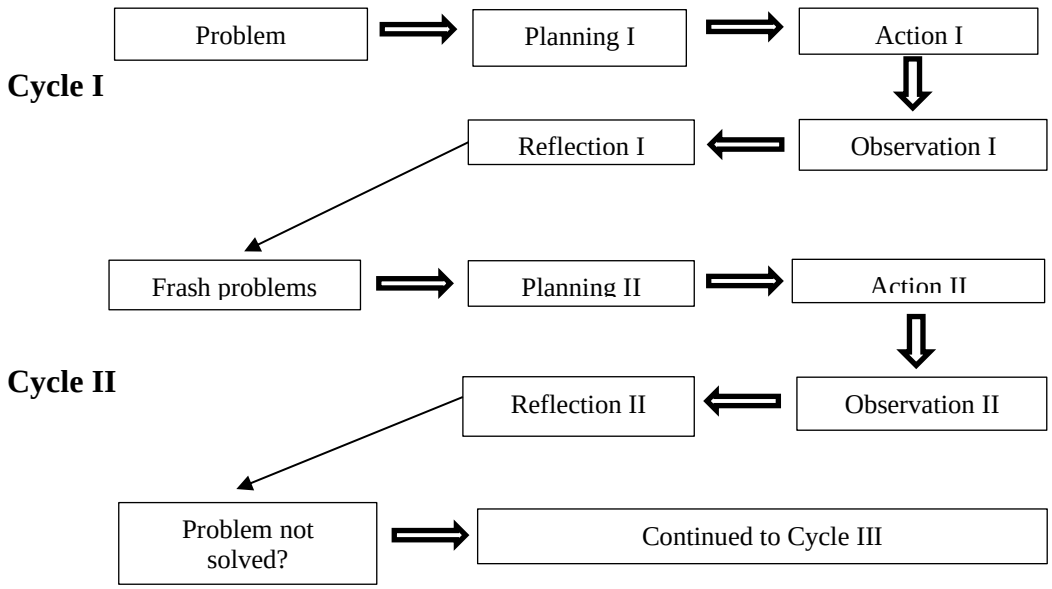

Figure 1. Flow of Research Implementation (Susanto, 2022)

The study consisted of two cycles. Each Cycle began with a planning stage, which involved preparing teaching materials and the necessary data collection tools, followed by an implementation stage, where actions were taken according to the prepared teaching module. This was followed by an observation stage, during which the teaching process was observed. The final stage was reflection, where the findings from the first Cycle were assessed. The outcomes from the first and second cycles would determine whether a subsequent cycle was necessary. If the research outcomes met the predetermined targets, further cycles would not be needed. The research process is illustrated in Figure 1.

Results and Discussion

Pre-Cycle

Before implementing the guided inquiry method, an initial evaluation of student ability on the topic of conventional biotechnology was conducted through a test. The initial test results showed that out of 40 students who took the test, only 18 met the passing standard (KKM), while 22 students fell below the required standard. The average score of the learning outcomes before using the guided inquiry model was 69, with a learning mastery rate of 45%.

Cycle I

In the first Cycle, teaching was conducted through three sessions, each lasting 2 x 35 minutes. In the first two sessions, the learning method used was experimentation with implementing the guided inquiry model. In the third session, a final test was conducted to evaluate student learning outcomes after completing the first Cycle.

After implementing the guided inquiry model in Cycle I, the student learning outcomes indicated that the learning activities had started to run effectively. Student achievement in conventional biotechnology showed significant improvement after applying the guided inquiry model compared to the pre-cycle achievement level. This was evidenced by the number of students who met the passing standard, totalling 26 out of 40 students. However, the number of students did not meet the passing standard was 14. The average student learning outcome in Cycle I was 78, with a learning mastery rate of 65%. Although there was an improvement, there is a need for further improvement in the subsequent cycles to maximize learning outcomes.

This result suggests that the student achievement in the first Cycle did not meet the expected mastery standard, indicating that the learning activities were not yet optimal. The lack of success in Cycle I indicated that the learning activities were still not running efficiently. Groups of students could not collaborate effectively due to excessive talking, leading to ineffective use of time during the experimentation. This was attributed to the lack of habituation in engaging directly in learning activities. Therefore, the teacher must address this issue before proceeding to the next Cycle.

Cycle II

In the second Cycle, teaching was conducted through three sessions with the same duration as in the first. In the first two sessions, the learning method was experimentation by implementing the guided inquiry model. In the third session, a final test was conducted to

evaluate student learning outcomes after completing the second Cycle. In this second Cycle, after the teacher addressed and corrected the shortcomings from the first Cycle by providing clear instructions to the students regarding the tasks or activities they should perform in groups and offering intensive guidance, students began to collaborate, engage actively, and report their outcomes effectively. Furthermore, significant progress was observed in the learning outcomes of the students.

By consistently applying the guided inquiry model, particularly focusing on the implementation in Cycle II, there was a significant improvement in student learning outcomes. This was evident from the fact that out of 40 students who took the test in Cycle II, 36 reached the passing standard, while four still fell below the required level (Table 1). The average student learning outcome in Cycle II was 85, with an overall mastery rate of 90% (Figure 2). This success was due to the consistent application of the guided inquiry model and the researcher's greater focus on implementing the action in Cycle II.

Table 1. Student Learning Completeness in Pre-cycle, Cycle I, and Cycle II

No	Criterion	Pre-cycle	Cycle I	Cycle II	Description
1	Total score	2763	3158	3422	Increasing
2	Average	69	78	85	Increasing
3	Percentage of completeness learning	45%	65%	90%	Increasing
4	Percentage of incompleteness learning	65%	35%	10%	Decreasing
5	Number of students' completeness	18	26	36	
6	Number of students' incompleteness	22	14	4	

The evaluation of classroom action research at Madrasah Aliyah Miftahul Ulum Bettet Pamekasan revealed improvements in the learning process through the consistent application of the guided inquiry model to 10th-grade students, particularly in the biology subject with the theme of conventional biotechnology. The increased learning outcomes achieved positively impacted the overall quality of learning. The significant enhancement in students' biology learning abilities, especially in their understanding of biology concepts, resulted in satisfactory outcomes. Using the guided inquiry model in the 10th-grade girls' biology subject at Madrasah Aliyah Miftahul Ulum Bettet Pamekasan successfully boosted learning outcomes with optimal achievement.

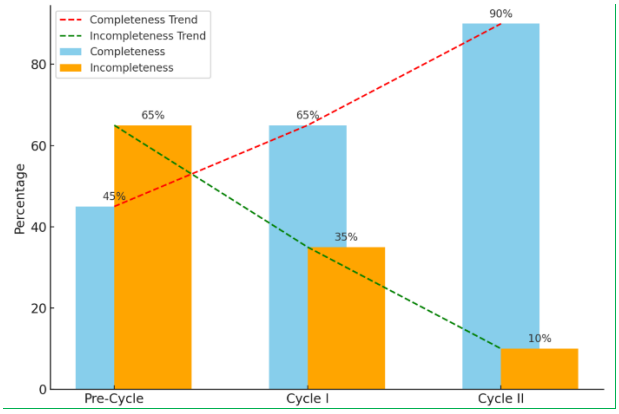

Figure 2. Graph of the Trend in Student Learning Completeness (Blue) and Incompleteness (Orange)

These findings align with the results of previous research conducted by Fausy et al. (2023), which demonstrated that applying the guided inquiry model in learning positively impacts students' learning outcomes. Their study showed a significant increase from 60% before the intervention to 84% after implementing the guided inquiry model. Similar findings were also reported by Nanlohy et al. (2023), where their research described how implementing the guided inquiry model significantly contributed to improving students' learning outcomes. After the learning process was conducted through the application of the guided inquiry model, students showed greater interest and enthusiasm in participating in the learning process (Fahmia et al., 2019). This was evident from the collaboration built within the group and their curiosity about the problems, which encouraged them to be more motivated to hone their knowledge independently with guidance from the teacher (Damhuri et al., 2020). The collaboration within the group allows students to exchange opinions, enabling those with a better understanding to share information with those who need assistance. This situation creates additional motivation for students, which can impact their improved learning outcomes (Lovisia, 2018).

The increase in students' learning outcomes in each Cycle proves that guided inquiry positively impacts learning (Megawati, 2021). In this learning method, students are not merely passive listeners to the lessons delivered by the teacher but actively solve the problems presented by the teacher (Huki et al., 2023). As students discover solutions, they receive intensive guidance, and the teacher provides support through questions and multi-directional discussions, enabling students to grasp the concepts being studied (Verdianingsih et al., 2021). One of the advantages of the guided inquiry approach is that students have a significant opportunity for discovery, allowing them to understand the material being studied quickly (Fahmia et al., 2019). Conditions like these are suspected to be the reason behind the high learning outcomes at the end of the research cycles.

Conclusion

The results of implementing guided inquiry in the learning process at Madrasah Aliyah Miftahul Ulum show an increase in learning outcomes in biology, particularly in conventional biotechnology. This is evidenced by a decrease in the percentage of incomplete learning outcomes and an increase in the percentage of completed learning outcomes. The students' learning outcomes also showed a positive trend, improving from the pre-cycle to cycle II. The results of this study can serve as a reference for enhancing students' learning outcomes by implementing the guided inquiry model.

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