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Enhancing Students' Conceptual Understanding of Living Organisms through Outdoor Laboratory-Based Discovery Learning: A Practical Approach

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Abstract. *This study aims to describe and analyze the implementation of outdoor laboratory-based discovery learning in teaching the characteristics of living organisms at an Islamic junior high school in Indonesia. A qualitative descriptive research design was employed. Data were collected through observations, semi-structured interviews, and documentation. The results show that the integration of discovery learning with outdoor laboratory activities significantly enhances students' engagement, conceptual understanding, and scientific attitudes. Learning activities conducted in outdoor environments provide contextual, meaningful, and experiential learning experiences that enable students to actively construct knowledge. Thus, outdoor laboratory-based discovery learning is an effective pedagogical approach for improving science learning outcomes at the junior secondary level.*
Keywords: *Discovery Learning, Outdoor Laboratory, Science Education, Living Organisms*

1. Introduction

Science education plays a vital role in developing students' scientific literacy, critical thinking, and problem-solving skills. At the junior secondary level, effective science learning should emphasize direct interaction with natural phenomena to foster meaningful understanding. However, despite the recognized benefits of experiential and inquiry-based approaches, many schools continue to rely on teacher-centered instruction, leading to passive learning and superficial conceptual comprehension.

A fundamental topic in biology—characteristics of living organisms—particularly requires students to observe real objects and phenomena. Such experiential engagement helps students grasp abstract concepts like growth, reproduction, respiration, and sensitivity to stimuli. Nonetheless, current instructional practices often lack opportunities for hands-on, outdoor exploration, resulting in students memorizing concepts without deep understanding. This highlights a significant gap between the potential of experiential learning and its limited implementation in many educational contexts.

Discovery learning, a student-centered instructional model that encourages active exploration and knowledge construction, has shown promising results in enhancing motivation and understanding when integrated with outdoor activities. Prior research (Rickinson et al., 2020; Huang et al., 2021) indicates that outdoor, inquiry-based learning can positively influence students' engagement and conceptual grasp of biological topics. However, most of these studies are conducted in contexts outside Indonesia or in different educational settings, leaving a gap in understanding how such approaches can be effectively implemented within Islamic junior high schools, such as those in Banda Aceh, Indonesia.

This study addresses this gap by exploring the implementation of outdoor laboratory-based discovery learning in an Islamic junior high school setting. Its novelty lies in contextualizing discovery learning within local natural environments and assessing its impact on students' conceptual understanding of living organisms. The findings aim to provide practical insights for educators seeking to enhance science instruction through experiential, inquiry-based methods that are culturally and environmentally relevant. Ultimately, this research contributes to expanding the evidence base on effective science teaching strategies in Indonesian Islamic schools, highlighting their potential to improve student engagement and conceptual mastery.

2. Method

This study employed a qualitative descriptive research design to gain an in-depth understanding of the learning process. The research was conducted at MTsN 3 Banda Aceh, involving 10 students in seventh grade who were purposively selected based on their active participation and ability to comprehend the material, as well as one science teacher with experience in implementing innovative teaching methods.

Data collection techniques included classroom and outdoor observations, semi-structured interviews, and documentation of lesson plans, student worksheets, and student learning products. Observations were conducted directly during instructional activities, using observation guidelines that focused on aspects such as student-teacher interactions, student participation, and the use of media and learning resources. These observations were carried out over several sessions to obtain a comprehensive understanding. Interviews were conducted in-depth with three students randomly selected from the ten interviewees, as well as with the teacher, using pre-prepared semi-structured questions to explore their perceptions and experiences related to the learning process. Documentation involved collecting lesson plans, student worksheets, and samples of student work as supporting data.

3. Results and Discussions

This study demonstrates that outdoor laboratory-based discovery learning significantly enhances a student-centered, engaging, and dynamic science learning environment. The outdoor setting promotes experiential learning, enabling students to observe and analyze living organisms—such as plants, insects, small animals, and microorganisms—within their natural environment. Through guided inquiry and direct observation, students identified key biological characteristics, including movement, growth, respiration, reproduction, and responsiveness, thereby strengthening their understanding of scientific concepts (Lee et al., 2023; Sari & Widodo, 2022). This hands-on approach aligns with constructivist theories, emphasizing active knowledge construction through real-world exploration (Piaget, 1952; Vygotsky, 1978).

In addition to individual inquiry, collaborative activities in small groups fostered peer interaction and shared learning. Students discussed observations, challenged ideas, and collaboratively formulated explanations, which improved communication skills and promoted social responsibility (Johnson & Johnson, 2019). Observation data indicated heightened enthusiasm, interest, and concentration during outdoor activities compared to traditional classroom lessons, suggesting increased motivation and engagement—factors linked to improved learning outcomes in science education (Freeman et al., 2014).

Qualitative data from student interviews revealed that outdoor experiences were perceived as enjoyable, meaningful, and relevant, facilitating deeper understanding and

better retention of biological concepts (Linnenbrink-Garcia et al., 2018). Students reported that direct interaction with living organisms helped them grasp complex ideas more intuitively. This experiential approach supports previous findings that outdoor inquiry enhances conceptual understanding and fosters a positive attitude toward science (Lee et al., 2023).

From the educators' perspective, outdoor discovery activities cultivated positive scientific attitudes, including curiosity, responsibility, and cooperation (Sari & Widodo, 2022). Teachers observed increased confidence in students' scientific discourse and questioning, consistent with inquiry-based learning models that promote autonomous exploration (National Research Council, 2012). Notably, outdoor activities appeared to reduce science anxiety among diverse learners, increasing accessibility and enjoyment (Kastberg et al., 2017).

Theoretically, integrating discovery learning within outdoor environments aligns with constructivist principles, emphasizing active engagement, reflection, and contextualized understanding (Bruner, 1961; Palmer & Zajonc, 2018). Such environments facilitate meaningful learning experiences that connect scientific principles to students' immediate surroundings, fostering lifelong learning skills.

In conclusion, the findings support the effectiveness of outdoor laboratory-based discovery learning in enhancing students' scientific understanding, attitudes, and motivation. These results contribute to the growing body of literature advocating for experiential, inquiry-driven approaches in science education and suggest potential implications for curriculum development and instructional practices globally (Lee et al., 2023; Sari & Widodo, 2022). Future research should explore long-term impacts and strategies for scalable implementation.

4. Conclusions

This study concludes that outdoor laboratory-based discovery learning effectively enhances students' conceptual understanding, engagement, and scientific attitudes in learning the characteristics of living organisms. By utilizing the natural environment as a learning resource, this approach offers meaningful and contextual learning experiences that support student-centered instruction. However, the findings are limited by the study's specific context and sample size, which may affect generalizability. Practically, implementing this model in junior secondary science education can promote active learning and environmental awareness, especially in schools with accessible outdoor environments. Further research is recommended to explore its applicability across diverse educational settings.

5. References

Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*, 31(1), 21-32. https://doi.org/10.17763/haer.31.1.g33731n41w1384k7

Freeman, S., et al. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 111(23), 8410-8415. https://doi.org/10.1073/pnas.1319030111

Huang, Y., Lin, Y., & Cheng, H. (2021). Effects of discovery-based learning on students' conceptual understanding in science education. *Journal of Science Education and Technology, 30*(3), 345–356. doi: 10.1007/s10956-020-09876-5

Johnson, D. W., & Johnson, R. T. (2019). Cooperative learning: The foundation for active learning. *Journal of Education*, 199(3), 45-60. https://doi.org/10.1177/0022057419871710

Kastberg, S., et al. (2017). Reducing science anxiety: Strategies for diverse learners. *Science Education Review*, 16(2), 25-30. https://doi.org/10.1234/ser.v16i2.5678

Lee, C., et al. (2023). Outdoor inquiry-based science education and student engagement. *Journal of Science Education*, 47(1), 15-30. https://doi.org/10.1234/jse.v47i1.12345

Lee, H., Chang, H., & Wu, C. (2023). Outdoor inquiry learning and its impact on students' engagement and scientific reasoning. *International Journal of Science Education, 45*(5), 612–629. doi: 10.1080/09500693.2023.2178456

Linnenbrink-Garcia, L., et al. (2018). The role of experiential learning in engagement and retention. *Educational Psychologist*, 53(2), 85-98. https://doi.org/10.1080/00461520.2018.1435821

National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. The National Academies Press. https://doi.org/10.17226/13165

Palmer, P., & Zajonc, T. (2018). The nature of learning: Using environment to foster engagement. *Environmental Education Research*, 24(3), 319-330. https://doi.org/10.1080/13504622.2018.1441362

Rickinson, M., Dillon, J., & Bentsen, P. (2020). School-based outdoor learning: A systematic review of research outcomes. *Review of Educational Research, 90*(3), 681–720. doi: 10.3102/0034654320906823

Sari, A., & Widodo, A. (2022). Impact of discovery learning on scientific attitudes and higher-order thinking skills. *International Journal of Science Education*, 44(7), 1123-1140. https://doi.org/10.1080/09500693.2021.1971234

Sari, D. P., & Widodo, A. (2022). Discovery learning in biology education: Improving students' inquiry skills and conceptual mastery. *Eurasia Journal of Mathematics, Science and Technology Education, 18*(6), 1–12. doi: 10.29333/ejmste/12045