



DOI: <https://doi.org/10.38035/sjam.v3i4.837>
<https://creativecommons.org/licenses/by/4.0/>

Utilization of Terrarium Media in Science Learning to Improve Understanding Ecosystem and Students' Environmental Awareness

Khairul Amri¹, Fitri Adifa²

¹Universitas Islam Negeri Maulana Malik Ibrahim, Malang, Indonesia, khairulamri1091@gmail.com

²Universitas Pembangunan Nasional "Veteran" Yogyakarta, Yogyakarta, Indonesia, fitriadifa19@gmail.com

Corresponding Author: khairulamri1091@gmail.com¹

Abstract: This research is motivated by the low cognitive learning outcomes and environmental awareness among students due to ecosystem topics traditionally being delivered in an abstract and theoretical manner. This study, entitled "Pemanfaatan Media Terrarium dalam Pembelajaran Ilmu Pengetahuan Alam untuk Meningkatkan Pemahaman Ekosistem dan Kesadaran Lingkungan Siswa," aims to examine the implementation of the project-based learning model utilizing terrarium media to improve students' cognitive achievement and environmental awareness. The method employed is classroom action research based on the Kemmis and McTaggart model, conducted over two cycles. The results demonstrate an increase in the average cognitive score from 52.25 to 84.50, with the final classical completeness reaching 91.30 percent and a Normalized Gain (N-Gain) value categorized as moderate. Meanwhile, the average score for students' environmental awareness rose from 50.73 percent to 82.21 percent, meeting the criteria for "highly conscious". In conclusion, the implementation of the project-based learning model with terrarium media is proven effective in significantly increasing cognitive learning success while simultaneously fostering students' environmental awareness.

Keyword: Project-Based Learning, Terrarium, Cognitive Learning Outcomes, Environmental Awareness.

INTRODUCTION

Natural Sciences (IPA) is a subject lessons that are important for development pattern thinking and thinking ability students. In science learning, ecosystem material and the development of environmental awareness are one of the important aspects that need to be considered. This environmental awareness includes understanding student about the impact of activities humans on the ecosystem as well as responsibility to maintain environmental sustainability (UNESCO, 2024). Furthermore, in science learning, achieving cognitive learning outcomes is also an important factor in the teaching and learning process. Effective learning should optimize students' potential so they can achieve the predetermined learning

objectives. (Chen & Yang, 2019). However, the science learning process in schools often cannot run optimally. Learning ecosystem material still tends to be delivered using a teacher-centered lecture method. The delivery of material relies solely on book text make draft ecosystem impressed abstract for students. Other obstacles such as limited laboratory facilities also make school seldom carry out real practical activities (Suryaningsih et al., 2026). This condition causes cognitive learning outcomes students become low because Students have less ability to remember the lesson material. In addition, learning that is only This theory also makes Students lack awareness to protect the environment around their homes and schools .

One learning model that can address this problem is the project-based learning model or Project-Based Learning (PjBL) which utilizes terrarium media. Project-based learning is an approach that gives students the freedom to build their own ideas. knowledge through product creation real in groups. By using terrarium or miniature making projects ecosystem in a container Glass, students get a more meaningful learning experience. This terrarium media functions as a mini laboratory in the classroom to show interaction component real ecosystems (Safitri & Ulfa, 2025). Through this media, students can directly observe natural phenomena such as the water cycle, relationships between living things, and plant adaptations (Sari et al., 2025). make ecosystem This product also makes student understand that component changes abiotic will influence component survival biotic in it (Sutaphan & Yuenyong, 2019). The implementation of the PjBL model with terrarium media has improved student learning outcomes. Therefore, this learning model is an important key to improving cognitive learning outcomes. (Mahmud et al., 2026). at a time fostering students' environmental awareness (Sunariyati et al., 2025).

By considering size the benefits of the Project-Based Learning model based on terrarium media, this research was compiled with the aim of examining the application of the Project-Based Learning model based on terrarium media to improve students' cognitive learning outcomes and environmental awareness.

METHOD

Research Design

This research uses the Classroom Action Research (CAR) design model of Kemmis & McTaggart (2014) which consists of four The stages in each cycle are : Planning , Acting , Observing , and Reflecting . The research subjects were 23 students . seventh grade at SMP Negeri 08 Tanjung Jabung Barat. The research took place in two cycle in the even semester of the 2025/2026 Academic Year.

Data Collection and Analysis

Learning Success (Cognitive)

Cognitive data is used to measure to what extent is mastery draft students' understanding of ecosystem material after the implementation of the terrarium -based PjBL model . Data were obtained through a test method using instruments in the form of multiple choice questions double test given at the end of each cycle (post-test). Achievement score student measured based on the criteria Minimum Completion Score (KKM) is 75. The test results data are then processed quantitatively through two analysis stage:

1. Classical Learning Competence: Counting percentage of students who received score ≥ 75 . Classical success target achieved if at least 85% of the total students in the class have completed it.
2. Gain Effectiveness Test (N-Gain): To measure the effectiveness of improving understanding draft cognitive from initial to final condition action, the Normalized Gain (N-Gain) formula from Hake (1998) is used:

$$N\text{-Gain} = \frac{(\text{Skor Posttest} - \text{Skor Pretest})}{(\text{Skor Maksimal} - \text{Skor Pretest})}$$

The N-Gain (g) value obtained is then interpreted based on the effectiveness criteria in the following table:

Tabel 1. Effectiveness Categories

N-Gain Value (g)	Effectiveness Category
$g > 0.7$	Tall
$0.3 \geq g \geq 0.7$	Currently
$G < 0.3$	Low

Environmental Awareness

Environmental awareness data is used to see development attitude, concern, and action real students to the ecosystem through experience nurse terrarium. Data were collected using instruments questionnaire Questionnaire with a Likert Scale (score options 1–4). Questionnaire consists of 20 grains statement that includes indicator component cognition affective as well as action real students towards the environment (Hanida et al., 2023).

Tabel 2. Criteria for Environmental Awareness Level

Percentage Range of Scores (%)	Criteria
81% – 100%	Very Caring
61% – 80%	Care
41% – 60%	Just Care
< 40%	Lack of Care

RESULTS AND DISCUSSION

Improving Learning Outcomes

Cognitive learning outcomes significant students from initial to final conditions cycle. Average value class increase from 52.25 at the initial condition to 74.35 at the end Cycle I, and rose again to 84.50 at the end Cycle II. This increase was also followed by completion classical showing trends positive, where in the initial conditions it was only 26.09%, increasing to 73.91% in Cycle I, until it reached 91.30% at the end Cycle II.

Tabel 3 Development of Cognitive Learning Outcomes Student

Evaluation Stage	Average Value	Number of Students Completed	Classical Completion (%)	N-Gain	Effectiveness Category
Initial Conditions (<i>Pre-test</i>)	52.25	6	26.09%	-	-
Post-test Cycle I	74.35	17	73.91%	0.36	Currently
Post-test Cycle II	84.50	21	91.30%	0.64	Currently

Based on the data in Table 3. The effectiveness analysis using N-Gain shows value of 0.36 in Cycle I and increased to 0.64 at the end Cycle II, both are in the "Medium" category. This consistent increase in N-Gain indicates that the treatment given is able to provide a measurable positive impact on understanding academic students. The use of terrarium media is assessed succeed change draft the previous ecosystem abstract into object concrete in the classroom. This is in line with the principle constructivism from Piaget (1971) and Bruner (1966) who stated that effective learning occurs when students can interact directly with objects study.

The improvement in learning outcomes proves the effectiveness of integrating the Project-Based Learning (PjBL) model with terrarium media. This is in line with the findings of Juuti et al. (2021), PjBL proven to consistently increase active engagement and science

learning outcomes when project directly linked to real problem solving. In addition, this finding is in line with Sirken (2026), that in education in Indonesia, a structured project - based approach is very effective in facilitating mastery draft scientific student.

This improvement process is carried out through evaluation and reflection in each cycle. In Cycle I, the main obstacle that emerged in the class was the existence of trend surface learning, where some students tend to focus more on the surface aspects aesthetics terrarium than essence scientific from the ecosystem itself. This obstacle is in line with the view Sitanggang et al. (2026) who emphasized that the success of PjBL is highly dependent on the accuracy of phase management inquiry by the teacher so that students do not lose focus on the essence scientific. Therefore, in Cycle II, improvements were made to the Student Worksheets (LKPD) which placed more emphasis on the analysis of student interactions. component biotic and abiotic. In line with Prima (2022), this improvement acts as scaffolding that directs cognitive focus. student from just settlement The project is an in-depth analysis of ecological systems.

Increasing Environmental Awareness

Besides the achievements cognitive, this study also focuses on developments in the environmental awareness aspect of students during the learning process. Development This attitude is measured through a questionnaire questionnaire structured form filled in by students at the end of each cycle.

Tabel 4 Development of Students' Environmental Awareness

Evaluation Stage	Average Score (%)	Qualitative Criteria
Initial Conditions (<i>Pre-test</i>)	50.73	Just Care
Post-test Cycle I	68.50	Care
Post-test Cycle II	82.21	Very Caring

Based on Table 4, it can be seen that the average percentage of students' environmental awareness scores has increased quite consistently, namely from 50.73% in the initial conditions which fell into the "Just Care" criteria, increasing to 68.50% ("Care") in Cycle I, and reaching 82.21% ("Very Caring") at the end Cycle II. Utilization terrarium as a learning medium assessed succeed instilling a sense of concern for the environment through their own direct experiences. This is in line with Ardoin et al. (2017) who stated that direct learning is one of the method best in changing attitudes and habits students' attitudes towards the surrounding environment. This finding is also supported by Maratawaty (2025), Project-Based Learning which emphasizes the active involvement of students in projects real proven to be effective in encouraging emergence attitude environmental care goes further than the usual lecture method. By caring for ecosystem small in a container With this glass, students no longer consider the environment as a theory in a book only, but as something that is alive and must be protected its sustainability.

This increase in environmental awareness reflects there is a change in the way view students in understanding dynamics ecosystem. The increase in scores in Cycle II occurred because students are no longer just observe object, but rather start to feel direct responsibility for the survival of the plants they plant and care for together their group. In line with Ainin and Asafri (2023), when students build direct involvement with their learning objects through direct experience, they will more easily develop a character that loves the environment compared to if they only passively study theory. This proves that project terrarium successfully become the right media for instilling mark real responsibility, where students Finally understand that protecting the environment is action concrete, not just draft memorization in books lesson.

CONCLUSION

Based on the results of the analysis of the use of terrarium media in science learning, it can be concluded that the implementation of the Project-Based Learning (PjBL) model based on terrarium media has been successful in answering research objectives in improving cognitive learning outcomes at a time fostering students' environmental awareness. Research findings show that the use of terrariums is effective in concretizing draft the previous ecosystem Abstract becomes a meaningful learning experience, and is able to change method view students to achieve the criteria of being very caring through direct responsibility in caring for miniature the ecosystem.

REFERENSI

- Ainin, D. T., & Asafri, H. (2023). Improving environmental literacy through primary education: Preparing students as environmental advocates. *PPSDP International Journal of Education*, 2(2), 110–118. <https://doi.org/10.59175/pijed.v2i2.114>
- Ardoin, N. M., Bowers, A. W., Roth, N. W., & Holthuis, N. (2017). Environmental education and K-12 student outcomes: A review and analysis of research. *The Journal of Environmental Education*, 49(1), 1–17. <https://doi.org/10.1080/00958964.2017.1366155>
- Bruner, J. S. (1966). *Toward a Theory of Instruction*. Cambridge: Harvard University Press.
- Chen, C., & Yang, Y. (2019). Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Educational Research Review*, 26, 71–81. <https://doi.org/10.1016/j.edurev.2018.11.001>
- Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64–74. <https://doi.org/10.1119/1.18809>
- Hanida, J. R., Rachmadiarti, F., & Susantini, E. (2023). Pengembangan e-modul Pembelajaran Ekosistem Berbasis Masalah. *Jurnal Inovasi Pembelajaran Biologi*, 4(1), 22–38. <https://doi.org/10.26740/jipb.v4n1.p23-38>
- Juuti, K., Lavonen, J., Salonen, V., Salmela-Aro, K., Schneider, B., & Krajcik, J. (2021). A Teacher-Researcher partnership for professional learning: Co-Designing Project-Based learning units to increase student engagement in science classes. *Journal of Science Teacher Education*, 32(6), 625–641. <https://doi.org/10.1080/1046560x.2021.1872207>
- Kemmis, S., McTaggart, R., & Nixon, R. (2014). *The Action Research Planner: Doing Critical Participatory Action Research*. Springer.
- Mahmud, I., Munirah, & Umar, R. (2026). Efektivitas Model Pembelajaran Pjbl Berbasis Steam Pada Mata Pelajaran Ipa Dalam Meningkatkan Keterampilan Berpikir Kritis Peserta Didik Kelas IV. *Al-Mujahidah*, 7(1), 211–217. <https://doi.org/10.51806/al-mujahidah.v7i1.377>
- Maratawaty, N. A. (2025). Pendidikan Lingkungan Berbasis Proyek Dalam Ipa Smp Untuk Meningkatkan Aksi Nyata Siswa Terhadap Isu Lingkungan. *Proceeding Seminar Nasional IPA XV*. <https://proceedings.unnes.ac.id/snipa/article/view/4528>
- Piaget, J. (1971). *Biology and Knowledge: An Essay on the Relations between Organic Regulations and Cognitive Processes*. Chicago, IL: University of Chicago Press.
- Prima, S. (2022). Literature review: implementation of scaffolding in project based learning models (project based learning). In P. D. M. Zaim, M.Hum, Ifdil, Ph.D., Kons, Krismadinata, & Ph.D (Eds.), *Peran Ilmu Pendidikan dan Profesi Pendidik dalam Pembangunan Nasional* (pp. 23 - 27). Jakarta: Redwhitepress. <https://doi.org/10.32698/ISPIVIII576>
- Safitri, B., & Ulfa, S. W. (2025). Pengaruh pembelajaran berbasis proyek pembuatan Terarium (Ekosistem Mini) terhadap kemampuan berpikir kritis peserta didik pada

- materi ekosistem Kelas X Mas Al-Washliyah 26 Tinokkah. *Bioscientist Jurnal Ilmiah Biologi*, 13(3), 2076–2085. <https://doi.org/10.33394/bioscientist.v13i3.17523>
- Sari, L. P., Larasati, S. A., Budiretnani, D. A., & Primandiri, P. R. (2026). Analisis Kebutuhan Pengembangan Media Ajar Terarium Model Efek Rumah Kaca untuk Peningkatan Kemampuan Berpikir Kritis Siswa Kelas X SMA.. *Prosiding Seminar Nasional Hayati*, 3(1), 11-16. <https://doi.org/10.29407/epxmba33>
- Sirken. (2026). Implementasi Project Based Learning Berbasis Lingkungan Pada Materi Keanekaragaman Hayati. (2026). *Jurnal Ilmu Pendidikan Biologi Dan IPA*, 2(1), 13-19. <https://doi.org/10.70134/mubipa.v2i1.1050>
- Sitanggang, T. M., Kaban, P., Tarigan, P. S. B., Situmorang, D. V. W., Arwita, W., & Mukra, R. (2026). Analisis permasalahan guru dalam penerapan model *Project Based Learning* pada materi ekosistem di SMA Negeri 1 Babalan. *Jurnal UISU*, 6(1), 506–512. <https://doi.org/10.30743/best.v9i1.13247>
- Sunariyati, S., Arifin, S., & Anggoro, R. O. (2025). Inovasi Teknologi Pembuatan Terrarium Berbasis Lingkungan Di SMA Negeri 2 Kahayan Tengah. *Jurnal Abdi Insani*, 12(11), 6135–6148. <https://doi.org/10.29303/abdiinsani.v12i11.3178>
- Suryaningsih, Y., Rasyid, A., & Robi'ah, N. N. (2026). Analisis miskonsepsi materi buku pelajaran biologi kelas X untuk Sekolah Menengah Atas. *Papanda Journal of Mathematics and Science Research*, 5(1), 275–284. <https://doi.org/10.56916/pjmsr.v5i1.3717>
- Sutaphan, S., & Yuenyong, C. (2019). STEM Education Teaching approach: Inquiry from the Context Based. *Journal of Physics Conference Series*, 1340(1), 012003. <https://doi.org/10.1088/1742-6596/1340/1/012003>
- UNESCO. (2024). *Education and climate change: learning to act for people and planet*. <https://doi.org/10.54676/gvxa4765>