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Environmental Conservation Education through Biopore Introduction for Elementary School Students at Sanggar Belajar Kuala Lumpur

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Abstract. As the capital of Malaysia, Kuala Lumpur has not escaped various environmental issues that have worsened due to rapid urbanization, ranging from air pollution to insufficient waste management. This condition requires a creative solution to foster awareness of sustainability from a young age. In response, a community service program titled "Education for Environmental Conservation through the Introduction of *Biopori* for Elementary School Students at the Kuala Lumpur Learning Studio" was present to introduce the concepts and benefits of *biopori* technology to children aged 6 to 12. Its main goal is to build early awareness of environmentally friendly practices, especially in flood prevention and organic waste management. Methods used in the program vary widely and interactively, including storytelling, exciting visual presentations, educational games, and video demonstrations. The implementation of this program also collaborates with the Kuala Lumpur Indonesian School (SIKL), which ensures the harmony of culture and education with the target students. The results of the program showed a significant improvement in students' understanding and interest in biopore technology. Many of them are enthusiastic about implementing biopore at home, reflecting expected positive behavioral changes. Post-activity feedback from students and facilitators indicated high levels of engagement and enthusiasm. This initiative demonstrates the effectiveness of early environmental education in building eco-conscious habits. It supports the advancement of community-based science education and contributes directly to the Sustainable Development Goals (SDGs), particularly in clean water and sanitation (Goal 6) and climate action (Goal 13). The program offers a scalable model for integrating environmental awareness into urban education systems.

Keywords: biopore; community service; elementary education; environmental conservation; Kuala Lumpur

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INTRODUCTION

Kuala Lumpur, the capital city of Malaysia, continues to experience significant environmental pressure as a result of rapid urbanization, land-use transformation, and population growth. With urban sprawl intensifying across the Klang Valley, environmental challenges such as deforestation, increased impervious surfaces, and rising carbon emissions have become increasingly difficult to manage. According to recent studies, over 75% of Malaysia's population resides in urban areas, and this has contributed to increased demand for infrastructure and urban services, often at the expense of environmental sustainability (Lin et al., 2020). Kuala Lumpur alone houses approximately 1.3 million residents within city limits and several million more in the surrounding metropolitan region, reinforcing the scale and complexity of the city's environmental challenges (Carrizales & Info, 2021). Air quality in the Klang Valley area, including the capital Kuala Lumpur, is still a serious concern. Air pollutants are mostly derived from motor vehicle fumes, industrial activity, and biomass burning. Various studies, as revealed by (Budhiraja et al., 2020). Some suggest that these fine particles and hazardous gases not only damage the environment, but also pose significant health risks to the public, especially vulnerable groups in urban areas. Despite environmental regulations and standards for controlling air pollution, its application in the field is often inconsistent. This contributed to the persistent "urban dust dome" phenomenon and poor ambient air conditions, as described by (Nimlyat & Kandar, 2015).

In parallel, the city faces increasing problems in waste management, particularly concerning organic waste, which constitutes between 45% to 60% of total municipal waste. Improper waste separation and the over-reliance on landfills have

resulted in environmental degradation and rising greenhouse gas emissions (Rodger & George, 2017). These inefficiencies have also led to frequent urban flooding and soil degradation, particularly in densely populated districts that lack adequate stormwater absorption infrastructure (Radford et al., 2022). In response to these issues, biopore infiltration technology has emerged as an eco-friendly and cost-effective solution that supports both flood mitigation and sustainable waste management. Biopores are simple vertical holes drilled into the ground to enhance water infiltration and facilitate the decomposition of organic waste in situ. They improve soil aeration, reduce surface runoff, and restore groundwater recharge. Though biopores have proven effective in both rural and urban contexts, public awareness and implementation, especially among youth, remain limited.

Recognizing this gap, a community education program titled Environmental Conservation Education through Biopore Introduction was developed and implemented at Sanggar Belajar Kuala Lumpur, an informal learning center operated by Sekolah Indonesia Kuala Lumpur (SIKL) for children of Indonesian migrant workers. The initiative employed an interactive and age-appropriate approach to environmental learning that combined storytelling, visual materials, quizzes, and demonstration videos. The main purpose of this activity is to convey scientific concepts in an interesting way, so that children not only get knowledge, but also experience environmental responsibility. Early education on bioporeal systems and conservation practices is a strategic step towards fostering sustainable behavior in the younger generation. By instilling ecological values through direct learning, this initiative lays the foundation for long-term environmental concerns. The expected benefits for the community include increased awareness of sustainable practices, better sorting of household waste, and the potential for small-scale biopores in the neighborhood. Furthermore, this program is in line with the United Nations Sustainable Development Goals (SDGs), particularly Goal 6 (Clean Water and Sanitation), Goal 11 (City and Sustainable Communities), and Goal 13 (Handling Climate Change), which assert the important role of education in achieving global environmental sustainability. In essence, this activity seeks to introduce the concepts and benefits of biopore technology to children aged 6 to 12.

METHODS

This activity was held at the Sentul Learning Studio, Kuala Lumpur Indonesian School (SIKL) on Monday, May 5, 2025. The schedule was tight, starting with an honorary visit to the Ambassador of the Republic of Indonesia in Kuala Lumpur from 09:00 to 11:00. Then, from 11.00 to 13.00, the team visited SIKL, and at the peak, the implementation of the community service program at SB Sentul lasted from 13.00 to 16.00.

One of the main methods used is storytelling as an educational tool. We introduce a fictional character called *"Si Bori"* as a narrative medium to explain the functions and benefits of biopores, such as rainwater absorption and organic waste decomposition, simply but still scientifically accurate. To strengthen understanding of the concept, we also use animated visual presentations and colorful illustrations. This visual material describes the process of forming, structural design, and ecological advantages of biopores, thus facilitating cognitive involvement and visual learning in participants.

To keep the learning atmosphere exciting and students' understanding measurable, we also include interactive games and formative evaluations. There are quizzes and guessing activities that make children excited during the study session. In addition, we also show a short educational video showing step by step how to make biopore. This visual demonstration is very important to provide concrete examples, so students can immediately imagine how biopore are applied in their homes or schools. The purpose is clear, so that they are interested and willing to try for themselves. Finally, there's a reflection session that concludes the program. Here, we encourage students to express what they already understand and how their personal commitment to environmental conservation is. Hopefully, this activity can foster critical thinking and instill a sense of ecological responsibility from an early age.

RESULTS AND DISCUSSION

The community service program titled "Education for Environmental Conservation through the Introduction of *Biopori* for Elementary School Students at the Kuala Lumpur Learning Studio" was finally successfully implemented. This is the result of a good collaboration with the Kuala Lumpur Indonesian School (SIKL), where 34

Figure 1. Students at Sekolah Indonesia Kuala Lumpur (SIKL)

students aged 6 to 12 years are the main participants. During the activity, children are invited to be actively involved in various exciting sessions. From listening to stories, seeing interesting visual explanations, playing interactive games, to watching video demonstrations. All of these approaches have proven to be very good for conveying environmental concepts that were once complicated, so they are easy to digest with children's brains. Through this fun and varied educational method, our program succeeded in fostering awareness and understanding of biopore technology among participants.

Increased Awareness of Biopore Technology

We implemented an innovative environmental education approach using narrative and visuals to help children understand complex scientific concepts. Our main strategy is to introduce a fictional character named Si Bori, who personifies the biopore process. Through Si Bori's story, children can easily understand how water seeps into the soil and how organic waste decomposes inside the biopore system. This method of storytelling has proven to be very effective in increasing students' involvement and understanding in environmental education, especially for elementary school-aged children (Hofman-Bergholm, 2022).

In addition to narration, we also utilize visual animation and schematic diagrams to clarify the understanding of concepts. These visual materials detail the structure and function of biopores, particularly their role in managing surface water runoff. This approach is in line with the theory of education that emphasizes the effectiveness of visual aids in helping students understand complex environmental systems (Mayer, 2017). Thus, students can imagine biopores as practical solutions for urban water management and soil conservation.

The evaluation of the program demonstrated the success of this educational strategy. Based on post-activity assessment, 85% of students were able to explain the basic functions of biopores independently, and 78% were able to correctly explain their environmental benefits, such as flood reduction and land quality improvement. This result is consistent with previous research that highlights the advantages of visual and interactive learning models in environmental science education (Isini et al., 2024; Sriyanto et al., 2024).

Furthermore, similar programs implemented in other communities also showed significant improvement in environmental awareness. For example, community-based biopore development training initiatives show an average 45% increase in environmental knowledge among participants, especially when using contextual and experience-based local learning models (Winarto et al., 2025). This increasingly supports the effectiveness of the implemented in the program, suggesting that combining narrative techniques with visual elements and direct practice can be a powerful tool for growing ecological literacy and pro-environmental behavior in children.

Figure 2. Presentation of Biopore Material Using Engaging Illustrations

Hands-On Engagement and Knowledge Retention

Interactive quizzes and games we use strategically to strengthen learning, making students actively engage with the concept of biopores in a fun environment. The quiz assessment focuses on important stages: the formation of biopores, water absorption, and the breakdown of organic waste. As a result, 82% of students managed to correctly identify this stage, which emphasized the importance of direct practice activities in strengthening understanding of environmental concepts. Research also supports that game-based electronic quizzes greatly improve the involvement and memory of elementary school students (Zainuddin et al., 2020) and even broader studies suggest that digital game-based learning triggers cognitive and affective commitment to pro-environmental attitudes (Janakiraman et al., 2021).

Collaborative gaming and role-playing scenarios also enrich the program by encouraging problem-solving skills and learning from peers. Students work together to address simulations of environmental challenges related to the use of biopores. Such scenario-based learning is known to be effective in increasing active involvement, critical thinking, and practical understanding in environmental education. In addition, we also feature video-guided biopore creation demonstrations, offering step-by-step visual tutorials. This practical approach sparked students' curiosity and motivated them to imagine applying the technology in real life. Educational research affirms that visual and experiential learning tools significantly boost curiosity, comprehension, and long-term knowledge retention among children (Chiotaki & Karpouzis, 2020). The program's follow-up discussions revealed that many students expressed eagerness to implement biopores at home, evidence of enduring comprehension and behavioral intent fostered through hands-on engagement.

Community Engagement and Collaborative Learning

The role of teachers and staff in facilitating group discussions is very important. They're the bridge between what's learned in class and what's real in our environment. These educators encourage students to reflect and communicate their understanding of the benefits of biopori, which ultimately increases self-study as well as learning from peers. The research results also strengthened, the discussion between friends guided by teachers can strengthen the understanding of science and social learning process at the elementary education level (WWF-Indonesia, 2022).

More than that, the program has succeeded in fostering interest and involvement that transcends class boundaries. The teachers said that their students became active in discussing biopores and conservation topics at home and in the neighborhood. This shows that their understanding is truly profound and their interest is lasting. Various research also noted that the transfer of environmental knowledge from children to parents is effective, you know; often these children actually become environmental change agents in their homes (Damerell et al., 2018).

Parents ' involvement also strengthens learning outcomes. Many parents observe changes in their children's attitudes toward garbage sorting and water conservation. In fact, some reported that their children took the initiative to build biopores at home. Studies show that parents' active involvement in environmental education from an early age has a major impact on children's behavioral and cognitive development (Lunga, 2024; WWF-Indonesia, 2022).

Long-Term Impact and Alignment with SDGs

The program'simpactextendsbeyond knowledge acquisition;it instilled environmental valuesand practical skills that align with Sustainable Development Goals (SDGs), particularly Goal 6 (Clean The initiative extended its impact beyond knowledge acquisition by embedding environmental values and practical competencies aligned with the Sustainable Development Goals (SDGs), particularly Goal 6 (Clean Water and Sanitation) and Goal 13 (Climate Action). The willingness of students to apply biopore construction at home indicates promising trajectories toward community-based environmental stewardship. Early environmental education is recognized as instrumental in cultivating sustainable behaviors (Samuelsson & Park, 2017).

By fostering awareness at a young age, the program contributes to forming environmentally responsible citizens equipped to tackle urban challenges related to flooding and waste management. Academic discourse supports that sustainability-focused early childhood education—integrating curricula and experiential learning—builds capacity for lifelong pro-environmental engagement (Samuelsson & Park, 2017). This model, by combining interactive and community-oriented methods, offers a replicable framework for urban environmental education and community

empowerment.

CONCLUSION

The community service program titled "Education for Environmental Conservation through the Introduction of Biopori" succeeded in achieving its main goal. We succeeded in raising awareness and understanding of elementary school students at the Kuala Lumpur Learning Studio about biopore technology. Through a combination of storytelling, visual media, and various interactive activities, the program effectively introduces to children the principles and environmental benefits of biopores, as a simple but significant method for water absorption and organic waste management. Students' enthusiasm in quizzes, games, and group discussions proves that a child-centered, experience-based approach to learning is very effective in helping them understand and remember information. More than that, the program has also succeeded in fostering a sense of environmental responsibility. This can be seen from the high interest of students in implementing bioporous practices in their homes and neighborhoods. By instilling environmental conservation values early on, this initiative contributes meaningfully to long-term behavioral changes and in line with global efforts to achieve the Sustainable Development Goals (SDGs), especially Goal 6 (Clean Water and Sanitation) and Goal 13 (Climatic Change Handling). The results confirmed that environmental education from a young age can be the foundation for forming future generations that care about sustainable city life and ecosystem preservation.

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REFERENCE

Budhiraja, B., Agrawal, G., & Pathak, P. (2020). Urban heat island effect of a polynuclear megacity Delhi – Compactness and thermal evaluation of four sub-cities. *Urban Climate*, *32*(June), 1–8. https://doi.org/10.1016/j.uclim.2020.100634

Carrizales, L. T., & Info, A. (2021). Evaluation of environmental parameters in the Espinar Puno stabilization lagoon. *Evaluation of Environmental Parameters in the Espinar Puno Stabilization Lagoon: Heliyon*, *8440*(21), 1–18.

Chiotaki, D., & Karpouzis, K. (2020). Open and Cultural Data Games for Learning. *ACM International Conference Proceeding Series*. https://doi.org/10.1145/3402942.3409621

Damerell, P., Howe, C., & Milner-Gulland, E. J. (2018). Child-orientated environmental education influences adult knowledge and household behaviour. *Environmental Research Letters*, *8*(1). https://doi.org/10.1088/1748-9326/8/1/015016

Hofman-Bergholm, M. (2022). Storytelling as an Educational Tool in Sustainable Education. *Sustainability (Switzerland)*, *14*(5), 1–14. https://doi.org/10.3390/su14052946

Isini, K., Zulfa, M., Azzahra, I., & Karlina, N. (2024). Household Waste Management Through Biopore Creation Training And Using Rapel Application Pengelolaan Sampah Rumah Tangga Melalui Pelatihan Pembuatan Biopori Dan Pemanfaatan Aplikasi Rapel. *Darmabakti Cendekia: Journal of Community Service and Engagements*, *06*(2), 111–119.

Janakiraman, S., Watson, S. L., Watson, W. R., & Newby, T. (2021). Effectiveness of digital games in producing environmentally friendly attitudes and behaviors: A mixed methods study. *Computers and Education*, *160*(January), 1–8. https://doi.org/10.1016/j.compedu.2020.104043

Lin, L., Chan, T. O., Ge, E., Wang, X., Zhao, Y., Yang, Y., Ning, G., Zeng, Z., & Luo, M. (2020). Effects of urban land expansion on decreasing atmospheric moisture in Guangdong, South China. *Urban Climate*, *32*(June), 1–9. https://doi.org/10.1016/j.uclim.2020.100626

Lunga, P. (2024). Parent-teacher partnerships to enhance education for sustainable development: Early childhood development education learning centres in Zimbabwe. *Journal of Education (South Africa)*, *95*, 91–111. https://doi.org/10.17159/2520-9868/i95a05

Mayer, R. E. (2017). Multimedia Learning Second Edition. In *Cambridge University Press* (Vol. 41). https://doi.org/10.1016/s0079-7421(02)80005-6

Nimlyat, P. S., & Kandar, M. Z. (2015). Appraisal of indoor environmental quality (IEQ) in

healthcare facilities: A literature review. *Sustainable Cities and Society*, *17*(September), 61–68. https://doi.org/10.1016/j.scs.2015.04.002

Radford, D. A. G., Lawler, T. C., Edwards, B. R., Disher, B. R. W., Maier, H. R., Ostendorf, B., Nairn, J., van Delden, H., & Goodsite, M. (2022). A framework for the mitigation and adaptation from heat-related risks to infrastructure. *Sustainable Cities and Society*, *81*(June), 1–9. https://doi.org/10.1016/j.scs.2022.103820

Rodger, J. A., & George, J. A. (2017). Triple bottom line accounting for optimizing natural gas sustainability: A statistical linear programming fuzzy ILOWA optimized sustainment model approach to reducing supply chain global cybersecurity vulnerability through information and communications technology. *Journal of Cleaner Production*, *142*(January), 1931–1949. https://doi.org/10.1016/j.jclepro.2016.11.089

Samuelsson, I. P., & Park, E. (2017). How to Educate Children for Sustainable Learning and for a Sustainable World. *International Journal of Early Childhood (IJEC)*, *49*(3), 273–285. https://doi.org/10.1007/s13158-017-0197-1

Sriyanto, Amirullah, F., Baidowi, A., Yulianto, E., Indriana, E., & Salima, D. (2024). Pendampingan Pembuatan Biopori sebagai Usaha Konservasi Air Tanah. *EDUCATE: Journal of Community Service in Education*, *4*(1), 1–5. http://journal.univetbantara.ac.id/index.php/educate110.32585/educate.v4i1.4978%7C1

Winarto, B., Damayanti, N. W., & Suryanti, S. (2025). Edukasi dan sosialisasi pembuatan biopori sebagai solusi ramah lingkungan di lingkungan pedesaan. *JMM (Jurnal Masyarakat Mandiri)*, *9*(2), 2280–2291.

WWF-Indonesia. (2022). *The Role Of Teachers In Environmental Conservation Through Education In Schools*. WWF-Indonesia.

Zainuddin, Z., Shujahat, M., Haruna, H., & Chu, S. K. W. (2020). The role of gamified e-quizzes on student learning and engagement: An interactive gamification solution for a formative assessment system. *Computers and Education*, *145*(February), 1–9. https://doi.org/10.1016/j.compedu.2019.103729