JPPIPA 11(10) (2025)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

# Integration of Local Medicinal Plant Potential Ethnobotany in Primary Schools as a Strategy for Strengthening Character Education and Health Literacy

Dewi Robiatun Muharomah[1*], Maya Rahayu[1]

[1]Biology Education Program, Bina Bangsa University, Indonesia

Received: August 30, 2025
Revised: September 27, 2025
Accepted: October 25, 2025
Published: Oktober 31, 2025

Corresponding Author:
Dewi Robiatun Muharomah
dewi.robiatun.muharomah@binabangsa.ac.id

DOI: 10.29303/jppipa.v11i10.12991



**Abstract:** This study aims to integrate the potential of local medicinal plants based on ethnobotany into primary school learning as a strategy to strengthen character education and health literacy. The research employed a Mixed-Methods Sequential Exploratory (MMSE) design, beginning with a qualitative phase through interviews and observations with local communities around Mount Karang, Pandeglang. The qualitative exploration identified 15 species of local medicinal plants that are still commonly used, both for daily health needs and as part of cultural heritage. These findings were then operationalised into test items and questionnaires, which were subsequently administered in the quantitative phase to 43 primary school students. The results demonstrated a significant improvement after the integration of ethnobotanical content in learning. Students' understanding of medicinal plants increased from 45% to 80%, environmental care attitude from 50% to 85%, responsibility from 60% to 88.7%, and the application of healthy living from 48% to 84%. These findings indicate that integrating local medicinal plants into the curriculum not only enhances students' health literacy but also fosters values of care and responsibility rooted in local wisdom. In conclusion, this research highlights that ethnobotany-based learning can serve as an effective strategy to nurture healthy, responsible, and culturally grounded young generations in primary schools.

**Keywords:** Character education; Elementary school; Ethnobotany; Health literacy; Local medicinal plants.

## Introduction

Basic education is an important foundation in shaping the character and literacy of students. In line with the Merdeka Curriculum paradigm, learning is required to be contextual, relevant, and based on real life. One potential area that can be integrated is local medicinal plants, which have long been widely known in the tradition of ethnobotany. Ethnobotany, as a science that studies the relationship between humans and plants, provides a scientific and cultural basis for learning based on local wisdom. In Indonesia, the diversity of medicinal plants is not only valuable medically, but also rich in cultural, ethical, and philosophical meaning for the community.

The integration of local medicinal plant ethnobotany into primary school curricula is a critical strategy that must be implemented to address concurrent educational and public health challenges. From a character education perspective, this approach fosters environmental stewardship, cultural pride, and social responsibility by connecting students to indigenous knowledge and community elders, thereby strengthening local identity and ethical values. Simultaneously, it builds essential health literacy by

**How to Cite:**
Muharomah, D. R., & Rahayu, M. (2025). Integration of Local Medicinal Plant Potential Ethnobotany in Primary Schools as a Strategy for Strengthening Character Education and Health Literacy. *Jurnal Penelitian Pendidikan IPA*, *11*(10), 1202–1209. https://doi.org/10.29303/jppipa.v11i10.12991

providing scientific, inquiry-based learning about plant properties, hygiene, and preventive care, empowering students to make informed health decisions. This integration is urgently needed to counteract the erosion of biocultural heritage and to promote sustainable health practices from an early age, creating a generation that is both culturally grounded and scientifically informed (Nurbaiti et al., 2022; Setiawan et al., 2022). Research confirms that such place-based education significantly enhances students' environmental attitudes and cognitive learning outcomes, making it a vital pedagogical intervention (Khusniati et al,. 2021a).

The urgency and viability of integrating local medicinal plant ethnobotany into primary schools are strongly supported by a robust body of recent research, which collectively underscores its dual benefits for character education and health literacy (Hasanah & Daesusi, 2019; Nurmasari et al., 2022; Patiola et al., 2023). Studies have consistently shown that such place-based learning significantly strengthens students' pro-environmental attitudes, conservation character, and cooperative skills by fostering a direct connection to biocultural heritage (Ichsan et al., 2020; Patiola et al., 2023). Concurrently, this approach effectively builds health literacy and scientific competencies, as using local medicinal plants as a learning context enhances understanding of health concepts and improves critical thinking more effectively than conventional methods (Fadilla et al., 2021). Furthermore, this integration successfully bolsters cultural identity and learning motivation by embedding indigenous knowledge into the curriculum, making education more relevant and engaging (Herwinda & Suryanda, 2022; Nadiroh et al., 2022). Critically, research confirms that this strategy yields superior cognitive outcomes and positive student responses (Pertiwi et al., 2022), and that practical, validated teaching tools like ethnobotany-based e-modules can be successfully developed for primary-level implementation (Azzahra & Hidayat, 2024). Together, these findings provide a compelling empirical foundation, demonstrating that the proposed integration is not only necessary for holistic student development but also pedagogically sound and implementable.

Local wisdom-based learning plays an important role in connecting students with their environment. Through the introduction of traditional medicinal plants, students not only gain cognitive knowledge but also internalise the socio-cultural values inherent in community practices. This connection strengthens local identity while also serving as a bulwark against the tide of globalisation that has the potential to erode traditional wisdom (Rahayu et al., 2021).

In addition, education that integrates ethnobotany contributes to strengthening 21st-century competencies. Students are trained to think critically through plant observation activities, collaborate in caring for school gardens, and communicate the benefits of medicinal plants to their peers. Thus, the learning process becomes more meaningful and transformative (Kivunja, 2014).

The context of health literacy has also become increasingly important in the post-COVID-19 pandemic era. Introducing local medicinal plants, such as ginger, temulawak, and turmeric, can be a gateway for students to understand the importance of preventive health care. This is in line with the concept of health literacy, which emphasises the ability of individuals to understand health information and use it in everyday decision-making (Bauer, 2023).

The integration of local medicinal plants in primary schools also supports the sustainable development agenda (Sustainable Development Goals/SDGs), particularly goals 3 (good health) and 4 (quality education). By teaching students from an early age about the potential of medicinal plants, schools are helping to preserve biodiversity while building sustainable ecological awareness (Le Blanc, 2015).

Furthermore, ethnobotany education at the elementary level can encourage the development of a generation that is not only physically healthy but also has a strong character in appreciating nature. Values such as caring, responsibility, and mutual cooperation can be instilled through simple activities such as planting, caring for, and utilising medicinal plants in the school environment (Mumpuni et al., 2013; Wibowo, 2016; Wibowo et al., 1991).

Finally, the relevance of integrating local medicinal plants into primary education lies not only in academic aspects, but also in moral and spiritual dimensions. Students learn that health and nature are gifts that must be preserved. Thus, ethnobotany serves as a holistic vehicle for building a generation with character, health, and roots in the nation's culture (Fitriana et al., 2018).

## Method

Mixed-Methods Sequential Exploratory (MMSE) is a mixed-methods research design that begins with a qualitative stage to explore phenomena in depth, followed by a quantitative stage to test, measure, or expand on initial findings. This model is widely used when prior knowledge about the research variables is limited or requires contextual exploration before more structured measurements are conducted.

This design was chosen because research on the integration of local medicinal plants in primary education requires a deep understanding of local wisdom (qualitative) as well as measurement of students' attitudes, knowledge, and responsibility (quantitative). Thus, MMSE enables the research to

produce a comprehensive picture, both in terms of cultural meaning and numerical data.

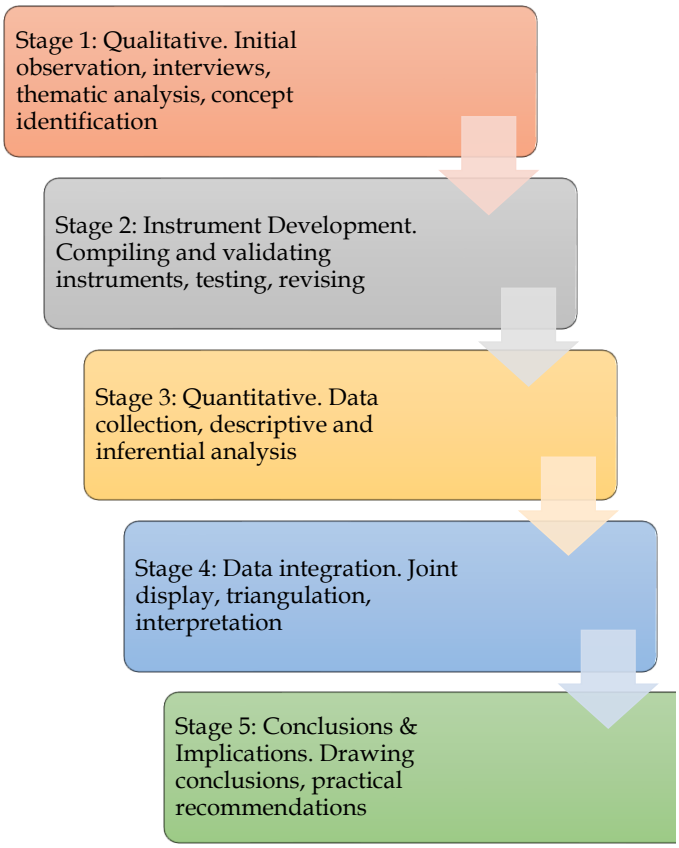


**Figure 1.** Mixed-Methods Sequential Exploratory Flowchart

*Research Stages*

*a. Qualitative Stage (Exploratory):*

Techniques: preliminary observation, in-depth interviews with the community (medicinal plant experts, local leaders, farmers).

Results: a list of medicinal plants unique to Mount Karang, Pandeglang, cultural values, and relevant character education themes were obtained.

*b. Instrument Development Stage:*

Qualitative data was used as the basis for developing knowledge tests, questionnaires on caring attitudes, responsibility, and insight into the benefits of medicinal plants. Content validity testing and preliminary trials were conducted to ensure the reliability of the instruments.

*c. Quantitative Stage:*

The instruments were administered to primary school students (n=43). Data were analysed descriptively (mean, score distribution) and inferentially (e.g. difference tests, correlations). The results are scores for knowledge, caring attitude, responsibility, and insight into the benefits of medicinal plants.

*d. Data Integration (Mixing):*

Qualitative and quantitative results are combined using *joint display* and triangulation. The findings complement each other: local community knowledge enriches student data, while student quantitative data validates the relevance of ethnobotany integration in learning.

By using the MMSE, the study not only describes the students' knowledge and attitudes quantitatively but also links them to the cultural richness of the local community. This provides a strong scientific basis for recommending an ethnobotany-based learning model as a strategy for strengthening health literacy and character education in primary schools.

## Result and Discussion

Before conducting the research, observations and interviews were first carried out regarding students' knowledge of medicinal plants around the school environment. The SDN Saruni 5 school environment is located in Kuranten Village, Saruni Sub-district, Majasari District, Pandeglang Regency, which has a high potential for plant diversity with the school located close to several forests and gardens around the school environment. The potential of plants in this environment can be utilised for the teaching and learning process. The integration of local medicinal plants (ethnobotany) is necessary to strengthen character education and health literacy for students. The following data on plants in the school environment can be used to support this research:

**Table 1.** List of local medicinal plants of Mount Karang-Pandeglang

| Local Name (Sunda/Pandeglang) | Scientific Name | Parts Used | Main Benefits (Properties) | Traditional Usage |
|---|---|---|---|---|
| Turmeric | *Curcuma longa* | Rhizome | Treats digestive problems, anti-inflammatory | Boiled, drink the water |
| Temulawak | *Curcuma xanthorrhiza* | Rhizome | Increases stamina, maintains liver function | Boiled, made into herbal medicine |
| Ginger | *Zingiber officinale* | Rhizome | Warms the body, prevents colds | Boiled, drunk warm |
| Galangal | *Alpinia galanga* | Rhizome | Antibacterial, remedy for itchy skin | Pounded, applied |

| Local Name (Sunda/Pandeglang) | Scientific Name | Parts Used | Main Benefits (Properties) | Traditional Usage |
|---|---|---|---|---|
| Betel leaf | *Piper betle* | Leaf | Antiseptic, oral health and external wounds | Boiled, the water is used for gargling |
| Kencur | *Kaempferia galanga* | Rhizome | Cough medicine, muscle aches | Ground, taken with honey |
| Sambiloto | *Andrographis paniculata* | Leaves | Reduces fever, boosts immunity | Boiled, the water is drunk |
| Brotowali | *Tinospora crispa* | Stem | Lowers blood sugar, increases appetite | Boiled, drunk |
| Meniran | *Phyllanthus niruri* | Whole plant | Antiviral, strengthens the immune system | Boiled, drunk |
| Cat's Whiskers | *Orthosiphon aristatus* | Leaves | Promotes urination, kidney medicine | Boiled, drink the water |
| Keji Beling | *Strobilanthes crispus* | Leaves | Breaks down kidney stones | Boiled, drunk |
| Pegagan | *Centella asiatica* | Leaves | Improves concentration, external wound treatment | Boiled, drunk/ applied |
| Lime | *Citrus aurantiifolia* | Fruit | Cough remedy, digestive aid | Squeezed, drunk with honey |
| Jatropha | *Jatropha curcas* | Leaves | Remedy for rheumatism, swelling | Leaves applied to the affected area |
| Fragrant Root (Fragrant Moon) | *Vetiveria zizanioides* | Root | Relaxation, traditional medicine for stress and aches | Boiled, the water is used for bathing |

Based on interviews with the community and teachers, the dominance of rhizomes and leaves as medicinal ingredients shows the community's attachment to the Mount Karang ecosystem, which is rich in *Zingiberaceae* and *Piperaceae* plants. The main benefits sought are the treatment of everyday ailments: coughs, fevers, digestive problems, and stamina maintenance. This illustrates the community's preventive and holistic approach to health.

Plants such as temulawak, turmeric, ginger, and betel leaves are not only used as medicine, but also have ritual and cultural value, for example in traditional ceremonies or family herbal medicine. The tradition of using medicinal plants is passed down orally from generation to generation, demonstrating the importance of transferring local knowledge, which now needs to be integrated into formal education.

Various types of local plants found in the school environment are used as learning materials and to introduce students to the use of medicinal plants to improve health literacy. Students learn about the parts of plants and the functions of each local medicinal plant. In this learning process, students are introduced to the classification of plant types and their morphology. Learning by inviting students to be directly involved can increase their motivation to learn more about the benefits of plants for health. Thus, students do not just memorise information but understand the extent of its use in everyday life. Students have a good understanding of the application of ethnobotany in relation to local medicinal plants. As a result, they learn about the use and preservation of these plants.

Based on the results of the study, the strengthening of character and health literacy among students at SDN Saruni 5 through questionnaires can be seen as follows.

**Table 2.** Results of the Integration of Local Medicinal Plants as Character Building and Health Literacy

| Aspect | Before Integration (%) | After Integration (%) |
|---|---|---|
| Understanding of Medicinal Plants | 45 | 80 |
| Environmental Awareness | 50 | 85 |
| Responsibility | 60 | 88.7 |
| Application of Healthy Living | 48 | 84 |

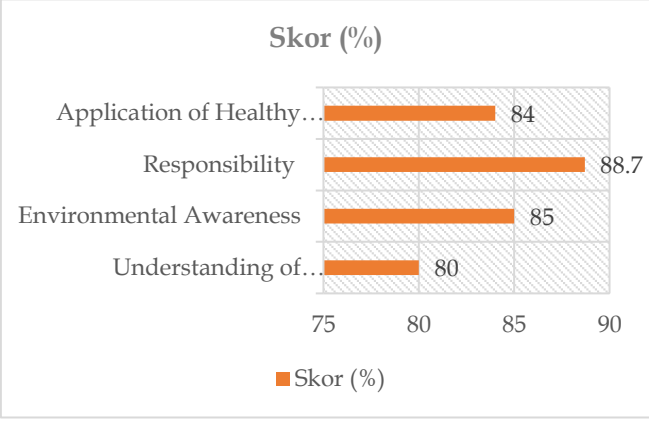


**Figure 1**. Integration of Local Medicinal Plants Ethnobotany as Character Building and Health Literacy

The following diagram shows the results of integrating local ethnobotanical medicinal plants to strengthen character and health literacy. Based on the survey results, it is known that direct involvement in ethnobotany activities encourages the development of student character, particularly responsibility, environmental awareness, and accountability. This is in line with Kong's research, which states that *school gardens* can foster student *engagement* and an environmentally conscious attitude (Walshe et al., 2024). In addition, student involvement in caring for medicinal plants fosters discipline (through watering schedules) and mutual cooperation (through the division of group tasks). Mini-herb parks in schools have a positive effect on the formation of collaborative attitudes and a sense of belonging to the school environment (Rahman et al., 2024). Character building and strengthening must be carried out systematically and continuously by involving several aspects such as *knowledge, feeling, and acting*. Basically, children with low character quality will have an impact on their social emotional development, which can lead to learning difficulties and difficulties in social interaction. Character is a form of personality that will stick to a person and its formation process lasts a lifetime. Responsibility, discipline, and environmental awareness are some of the goals in developing character through the educational process.

In addition to character building, another focus of the study was to improve health literacy. The majority of students demonstrated a fairly good initial understanding of the benefits of simple medicinal plants. However, the questionnaire also revealed that there were still doubts or misunderstandings, such as the assumption that all medicinal plants are safe to consume without dosage. This is consistent with the SHE review, which emphasises the importance of health education in schools to foster critical thinking skills in sorting through health information (Collins et al., 2021). The integration of ethnobotany into the curriculum has proven effective in expanding health vocabulary, improving children's ability to make simple decisions, and reinforcing the understanding that not all information about traditional medicine can be practised without adult guidance. These findings are supported by Research in Educational Practice, which emphasises that learning about medicinal plants needs to be accompanied by aspects of safety and source literacy (Rahman et al., 2024).

Previous studies consistently demonstrate the multifaceted benefits of integrating ethnobotany into education. Research by Khusniati found that ethnobotany-based inquiry learning significantly improved elementary students' critical thinking skills and fostered positive environmental attitudes (Khusniati et al., 2021b). Complementing this, a study by Nurbaiti showed that integrating local wisdom and socioscientific issues in biology learning effectively strengthened students' conservation character and environmental ethics (Nurbaiti et al., 2022). From a health literacy perspective, Setiawan concluded that project-based learning connected to local contexts successfully enhanced junior high school students' understanding and application of health concepts (Collins et al., 2021; Setiawan et al., 2022). Furthermore, Zidny argued that incorporating Indigenous knowledge, such as ethnopharmacology, into science lessons makes learning more engaging and culturally relevant for students, promoting both cognitive and affective outcomes (Ichsan et al., 2020; Zidny et al., 2023; Zulharman & Noeryoko, 2023).

The pedagogical effectiveness of this approach is well-documented. Research by Acharya in Nepal demonstrated that participatory ethnobotany education in schools increased children's knowledge of local medicinal plants and instilled a sense of responsibility for biodiversity conservation (Anwar et al., 2022; Ifa et al., 2019; Patiola et al., 2023; Setiawan & Wakhidah, 2023). Similarly, a study by Ulian highlighted that wild plant education programs can effectively transmit traditional knowledge to younger generations, thereby safeguarding biocultural heritage (Zulharman & Noeryoko, 2023). In the Indonesian context, Anisa reported that using an ethnoscience-based module on medicinal plants significantly improved elementary students' scientific literacy and conceptual understanding (Setiawan & Wakhidah, 2023). Finley also emphasized that place-based environmental education, which includes local ecological knowledge, is a powerful tool for developing students' ecological literacy and pro-environmental behaviors (Nadiroh, N., Hasanah, U., & Zulfa, 2022).

Finally, studies confirm its role in holistic character development. Febriani found that embedding local wisdom in science learning cultivated caring and responsible characters among elementary students (Ungu et al., 2022). Moreover, Sari demonstrated that an ethnobotany approach not only increased knowledge but also strengthened character values such as curiosity, diligence, and environmental care in primary school settings (Khalifah, 2019; Lee et al., 2021; Winaya & Murdihastomo, 2022).

The survey results show an increase in knowledge of medicinal plants — this is consistent with research finding that garden-based learning or ethnobotanical material improves children's understanding of plants and their biological functions. Studies on herb gardens on campuses/in schools state that direct experience (observation, care) improves knowledge retention and practical skills (Azzahra & Hidayat, 2024; Kartika et al., 2022; Zulharman & Noeryoko, 2023).

## Conclusion

Based on this study, integrating local medicinal plants significantly enhanced students' character building and health literacy, though variations among respondents indicated a need for more equitable reinforcement strategies. While students demonstrated good basic knowledge of plant benefits, their understanding remained largely superficial, lacking the depth of functional literacy. Interviews with local experts in Gunung Karang, Pandeglang, substantiated these findings, revealing a rich yet endangered heritage of at least 15 medicinal plants used for health and cultural purposes—knowledge traditionally transmitted orally but now threatened by the dominance of modern medicine among younger generations. Overall, the research confirms that ethnobotanical integration serves a dual strategic purpose: strengthening contextual, experience-based health literacy and fostering character values such as care, responsibility, and appreciation for local wisdom. Through data triangulation, the convergence of cognitive gains, affective attitudes, and community knowledge validates this approach as a relevant and effective model for the Merdeka Curriculum.

**Acknowledgments**

Thank you for the grant from the funding program Directorate of Research and Community Service of the Ministry of Higher Education, Science and Technology of the Republic of Indonesia and to Ali Fikri and Listya Almara, students of the biology education study program, who have assisted in the research in the implementation of research activities. I hope this research can be useful.

**Author Contributions**

all authors contributed together at every stage

**Funding**

This research was funded by the Directorate of Research and Community Service of the Ministry of Higher Education, Science and Technology of the Republic of Indonesia, grant number 8002/LL4/PG/2025,0143/I.1/LPPM/UNIBA/VI/2025 and Publication costs (APC) were funded by the Ministry of Education, Culture, Research, and Technology.

**Conflicts of Interest**

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

## References

Anwar, M. R., Soendjoto, M. A., & Dharmono, D. (2022). Practicality of pamplet learning media for Arecaceae family. *BIO-INOVED : Jurnal Biologi-Inovasi Pendidikan*, *4*(2). https://doi.org/10.20527/bino.v4i2.13186

Azzahra, F., F., & Hidayat, S. (2024). Development of an ethnobotany-based e-module for plant material for grade IV elementary school. *Jurnal Penelitian Pendidikan IPA*, *10*(2), 487–494. https://doi.org/https://doi.org/10.29303/jppipa.v10i2.5919

Bauer, U. (2023). The social embeddedness of health literacy. In *International Handbook of Health Literacy*. https://doi.org/10.56687/9781447344520-040

Collins, S. P., Storrow, A., Liu, D., Jenkins, C. A., Miller, K. F., Kampe, C., & Butler, J. (2021). *No Title 済無No Title No Title No Title*. *7*(3), 167–186.

Fadilla, N., Nurmalasari, Y., & Sari, D. M. M. (2021). The effect of local potential-based learning on the scientific literacy of elementary school students in science learning. *Jurnal Pendidikan Sains Indonesia*, *9*(4), 577–587. https://doi.org/doi.org/10.24815/jpsi.v9i4.20963

Fitriana, D., Prasetyo, B., & Purwaka, B. T. (2018). Inadequate fluid intake can increase the risk of constipation among pregnant women. *Majalah Obstetri & Ginekologi*, *25*(2). https://doi.org/10.20473/mog.v25i22017.48-53

Hasanah, I., & Daesusi, R. (2019). Studi etnobotani tanaman obat di Desa Bumiayu Kabupaten Bojonegoro dan pemanfaatannya dalam bentuk herbarium sebagai media pembelajaran biologi. *Jurnal Pedago Biologi*, *7*(2).

Herwinda, A., & Suryanda, A. (2022). Development of a module based on local wisdom of Sundanese ethnobotany on the concept of plant structure and function to increase learning motivation. *Biodidaktika: Jurnal Biologi Dan Pembelajarannya*, *17*(2), 75–86. https://www.semanticscholar.org/paper/Development-of-E-Module-Ethnobotany-Based-on-Lombok-MRofi'i-Sri/edb2c57a1d42744d0cf7f6a95ee56ff6510d2c52

Ichsan, I. Z., Sigit, D. V., Ristanto, R. H., Luthfi, I. A., Muharomah, D. R., Efendi, M., Panjaitan, R. G. P., Marhento, G., Widiyawati, Y., & Susilo, S. (2020). LOTS dan HOTS tentang tanaman obat: pembelajaran sains dan lingkungan saat new normal COVID-19. *Edubiotik : Jurnal Pendidikan, Biologi Dan Terapan*, *5*(02), 91–102. https://doi.org/10.33503/ebio.v5i02.888

Ifa, H., Yoga, D., Puspita, L., & Mazidah, U. (2019). Analisis Sosial Ekonomi Terhadap Tingkat Kesejahteraan Masyarakat Tengger Gunung Bromo. *Majalah Pembelajaran Geografi*, *2*(1).

Kartika, T., Utaridah, N., Windah, A., & Zaimasuri, Z. (2022). Literasi Pencegahan Sakit: Menjadi Lansia

yang Bahagia dan Sehat di Panti Jompo Tresna Werdha Natar Lampung Selatan. *Jurnal Pengabdian Dharma Wacana*, *3*(2). https://doi.org/10.37295/jpdw.v3i2.297

Khalifah, S. (2019). Literasi Tanaman Herbal (Studi Terhadap Pemanfaatan Tanaman Herbal Sebagai Alternatif Obat Dalam Upaya Membentuk Pola Hidup Sehat Pada Masyarakat Kelurahan Simpang IV Sipin Kota Jambi). *Skripsi*.

Khusniati, M., Heriyanti, A. P., Aryani, N. P., & Laksono, A. (2021a). The effectiveness of ethnobotany-based inquiry learning on the local plant potential to improve students' critical thinking and environmental attitudes. *PBI (Jurnal Pendidikan Biologi Indonesia)*, *7*(3), 219–230. https://doi.org/https://doi.org/10.22219/jpbi.v7i3.16247

Khusniati, M., Heriyanti, A. P., Aryani, N. P., & Laksono, A. (2021b). The effectiveness of ethnobotany-based inquiry learning on the local plant potential to improve students' critical thinking and environmental attitudes. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *7*(3), 219–230. https://doi.org/https://doi.org/10.22219/jpbi.v7i3.16247

Kivunja, C. (2014). Teaching Students to Learn and to Work Well with 21st Century Skills: Unpacking the Career and Life Skills Domain of the New Learning Paradigm. *International Journal of Higher Education*, *4*(1). https://doi.org/10.5430/ijhe.v4n1p1

Le Blanc, D. (2015). Towards Integration at Last? The Sustainable Development Goals as a Network of Targets. *Sustainable Development*, *23*(3). https://doi.org/10.1002/sd.1582

Lee, J. Y., Lee, Y. ae, & Yoo, M. S. (2021). Development of the child's ego strength scale: an observation-based assessment of the board game behaviors in play therapy in Korea. *Child and Adolescent Psychiatry and Mental Health*, *15*(1). https://doi.org/10.1186/s13034-021-00369-3

Mumpuni, K. E., Susilo, H., & Rohman, F. (2013). *The Potential of Local Plants as a Source of Learning Biology Seminar Nasional XI Pendidikan Biologi FKIP UNS HASIL PENELITIAN DAN PEMBAHASAN Tumbuhan Lokal*. 825–829.

Nadiroh, N., Hasanah, U., & Zulfa, V. (2022). Urgency for developing teaching materials based on Betawi local wisdom for ecological literacy. *AL-ISHLAH: Jurnal Pendidikan*, *14*(3), 3767–3776. https://doi.org/https://doi.org/10.35445/alishlah.v14i3.1855

Nurbaiti, S., Sajidan, S., & Karyanto, K. (2022). *Integrating ethnopedagogy and socioscientific issues in biology learning to strengthen student conservation character*. *11*(3), 503–515. https://doi.org/https://doi.org/10.15294/jpii.v11i3.36032

Nurmasari, N., Syamswisna, S., & Tenriawaru, A. B. (2022). Kelayakan Ensiklopedia Pada Submateri Pemanfaatan Keanekaragaman Hayati Dari Hasil Etnobotani Tumbuhan Obat. *Didaktika Biologi: Jurnal Penelitian Pendidikan Biologi*, *5*(2). https://doi.org/10.32502/dikbio.v5i2.4438

Patiola, R., Syamswisna, & Fajri, H. (2023). Pengembangan E-magazine Etnobotani Tumbuhan Obat sebagai Media Pembelajaran Kelas X SMA. *Jurnal Bioeducation*, *10*(2).

Pertiwi, U. D., Atanti, R. D., & Ismawati, R. (2022). The importance of local potential-based learning for biodiversity to improve cognitive learning outcomes. *BIOEDUKASI: Jurnal Pendidikan Biologi*, *13*(2), 94–99. https://doi.org/https://doi.org/10.20961/bioedukasi-uns.v13i2.41186

Rahayu, E., Rahmawati, L., & Sampirlan. (2021). Teknik Perbanyakan Tanaman Melinjo (Gnetum gnemon) Dengan Cara Okulasi Sambung. *KENANGA Journal of Biological Sciences and Applied Biology*, *1*(1). https://doi.org/10.22373/kenanga.v1i1.799

Rahman, A., Soendjoto, M. A., & Dharmono, D. (2024). Kepraktisan Aplikasi Android Etnobotani Tumbuhan Obat Terhadap Keterampilan Berpikir Kritis Mahasiswa. *Journal of Banua Science Education*, *5*(1), 75–85. https://doi.org/10.20527/jbse.v5i1.333

Setiawan, A. R., Puspaningrum, H., & Umam, K. (2022). Project-based learning integrated to STEM (STEM-PJBL) on photosynthesis topic to improve junior high school students' health literacy. *Biosfer: Jurnal Pendidikan Biologi*, *14*(2), 137–148. https://doi.org/https://doi.org/10.21009/biosferjpb.20568

Setiawan, D. A., & Wakhidah, A. Z. (2023). Botanical, ecology, phytochemical, bioactivity, and utilization of kelat oil (Syzygium myrtifolium Walp.) in Indonesia: A Review. *Jurnal Biologi Udayana*, *27*(1). https://doi.org/10.24843/jbiounud.2023.v27.i01.p09

Ungu, N. K., Faezhal, I. T., Dwi Ayu Febriyanti, Pujianti, I., Indriyni, A. D. N., Mubarok Ns, E. M. A., Qodam, Q., Suryaningrum, I., Nadzif, M., Umiyati, I., & Maulana, A. (2022). Pembuatan Taman Edukasi Toga (Tanaman Obat Keluarga) Di Desa Laranganku lon Kecamatan Mojotengah Kabupaten Wonosobo. *Jurnal Pengabdian Masyarakat Madani (JPMM)*, *2*(2). https://doi.org/10.51805/jpmm.v2i2.93

Walshe, R., Evans, N., & Law, L. (2024). School gardens and student engagement: A systematic review exploring benefits, barriers and strategies. *Issues in Educational Research*, *34*(2), 782–801.

Wibowo, A. P. (2016). Etnobotani Tumbuhan Obat Di Mancon Wilangan Kabupaten Nganjuk Sebagai Upaya Awal Konservasi Ex-Situ. *Ekonomi Akuntansi*, *01*(08).

Wibowo, T., Utama, P., & Amzu, E. (1991). Potensi dan Upaya Pelestarian Pemanfaatan Tumbuhan Obat di Taman Nasional Meru Betiri. *Media Konservasi*, *3*(2).

Winaya, A., & Murdihastomo, A. (2022). How Indonesian People in the Past Deal with Disaster Mitigation? An archaeological perspective. *Kapata Arkeologi*, *17*(1). https://doi.org/10.24832/kapata.v17i1.13-20

Zidny, R., Solfarina, S., Aisyah, R. S. S., & Eilks, I. (2023). The effect of integrating indigenous knowledge of medicinal plants into chemistry learning on students' pro-environmental attitudes. *Journal of Science Learning*, *6*(2), 207–218. https://doi.org/https://doi.org/10.17509/jsl.v6i2.51766

Zulharman, Z., & Noeryoko, M. (2023). Development of Ethnobotany Materials to Support Basic Concepts of Science Learning in Higher Education. *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 710–716. https://doi.org/10.29303/jppipa.v9ispecialissue.5328