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The use ethnobotany-based teaching modules to improve junior high school students' science literacy

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Abstract: The aim of this study is to ascertain the impact of ethnobotany-based teaching modules on the scientific literacy skills of junior high school students in the classification of living organisms. A one-group pretest–posttest design was implemented in the study, which employed pre-experimental research. Seventeen seventh-grade students participated in the study, which was conducted at a junior high school in Biluhu. Experts validated 10 scientific literacy test questions with a feasibility value of 88.67%, and a student response questionnaire was administered using a Likert scale. Descriptive statistics, N-gain, and paired sample t-tests were implemented to analyze the data. The findings indicated that the post-test average scientific literacy score of students increased from 50.78 in the pre-test to 77.65. The paired sample t-test results indicated significant differences between the scores prior to and subsequent to the learning experience ($p < 0.001$). Furthermore, students expressed their satisfaction with the ethnobotany-based teaching modules, with an average score of 97.45%. These findings suggest that the implementation of ethnobotany-based teaching modules has a beneficial impact on the scientific literacy abilities of students and has garnered favourable feedback in the context of junior high school science education.

Keywords: Classification of living things, ethnobotany, scientific literacy

Abstrak: Tujuan penelitian ini adalah untuk mengetahui dampak modul pembelajaran berbasis etnobotani terhadap kemampuan literasi sains siswa SMP dalam klasifikasi organisme hidup. Desain pretest-posttest satu kelompok diterapkan dalam penelitian ini, yang menggunakan penelitian pra-eksperimental. Tujuh belas siswa kelas tujuh berpartisipasi dalam penelitian ini, yang dilakukan di sebuah SMP di Biluhu. Para ahli memvalidasi 10 pertanyaan tes literasi sains dengan nilai kelayakan 88,67%, dan kuesioner respons siswa diberikan menggunakan skala Likert. Statistik deskriptif, N-gain, dan uji t sampel berpasangan diterapkan untuk menganalisis data. Hasil penelitian menunjukkan bahwa rata-rata skor literasi sains siswa pada pasca-tes meningkat dari 50,78 pada pra-tes menjadi 77,65. Hasil uji t sampel berpasangan menunjukkan perbedaan signifikan antara skor sebelum dan sesudah pengalaman belajar ($p < 0,001$). Selain itu, siswa menyatakan kepuasan mereka terhadap modul pembelajaran berbasis etnobotani, dengan nilai rata-rata 97,45%. Temuan ini menunjukkan bahwa implementasi modul pembelajaran berbasis etnobotani memiliki dampak positif pada kemampuan literasi sains siswa dan telah mendapatkan umpan balik yang baik dalam konteks pendidikan sains sekolah menengah pertama.

Kata kunci: Klasifikasi makhluk hidup, etnobotani, literasi sains

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INTRODUCTION

At the junior high school level, the conceptual focus of science education is the comprehensive development of students' scientific literacy, rather than the mere acquisition of factual knowledge (Mayasari & Usmeldi, 2023). Scientific literacy is the capacity of an individual to make reflective decisions and comprehend natural phenomena by utilizing scientific knowledge, identifying scientific problems, and drawing conclusions based on evidence (Jufrida et al., 2019; Nasir et al., 2024). Nevertheless, Indonesian learners

continue to face substantial obstacles in terms of their scientific literacy. Scientific literacy remains low, according to numerous studies. The scientific literacy skills of junior high school students are generally low, with a particular emphasis on the interpretation of scientific data and evidence, as well as the evaluation and design of scientific investigations. Their capacity to scientifically explain phenomena is classified as moderate (Amala et al., 2023; Nasor et al., 2023; Ramli et al., 2022). The indicator for explaining phenomena scientifically obtained an sufficient category, indicating that students' abilities are not yet optimal and need improvement (Sholikah & Pertiwi, 2021).

One of the science subjects that poses challenges in achieving scientific literacy is the classification of living things (Ali et al., 2025; Illah & Amelia, 2025). This material not only requires the ability to memorize taxonomic concepts but also requires observation skills, identification of organism characteristics, and systematic thinking skills to understand the relationships between organisms (Ardiyanti et al., 2022). Learning to classify living things should ideally not only focus on memorizing nomenclature but also provide direct experience through observation of biological objects in the students' environment. However, various studies show that classification learning often still uses a conventional approach, emphasizing memorization of organism characteristics and taxonomic levels (Rintang et al., 2024). This situation makes it difficult for students to connect classification concepts with real-world phenomena they encounter in their daily lives.

A similar problem was found based on initial observations at SMP Negeri 4 Satap Biluhu. The science learning process still tends to rely on textbooks as the primary learning source, while the surrounding environment is not being optimally utilized. Teachers reported that the learning tools, such as student worksheets, they used were not specifically designed to develop students' scientific literacy skills. Furthermore, the development of formative and summative evaluation instruments focused more on measuring conceptual mastery than on students' ability to analyze phenomena, use scientific evidence, and apply scientific concepts in real-life situations. This situation indicates that the available learning tools do not fully support the demands of science literacy-based learning.

In addition to the limited learning tools, interviews also revealed that varying learning approaches remains a barrier to science learning. Although the Independent Curriculum emphasizes conscious, meaningful, and enjoyable learning, many learning practices still rely on conventional models, perceived as effective in conveying material. As a result, students often act as recipients of information rather than active learners exploring, investigating, and reflecting on the concepts being learned. Science learning should, in fact, encourage students to connect scientific concepts with real-life experiences, thus fostering a deeper understanding (Nasir et al., 2024).

These issues indicate a gap between curriculum demands and learning practices in the field. The national curriculum has prioritized scientific literacy and contextual learning as core competencies to be developed, but its implementation still faces limitations in supporting learning tools. Furthermore, the potential of the local environment and culture around schools has not been systematically utilized as a resource for science learning. Local knowledge is often viewed as a community tradition, rather than as a source of knowledge that can be integrated with formal science concepts (Ahmad et al., 2025; Damopolii et al., 2026; Iksan et al., 2026; Sirait et al., 2024). However, integrating scientific knowledge and local wisdom can create more relevant and meaningful learning for students.

Ethnobotany is one potential approach to bridging this gap. The study of the relationship between humans and plants within a specific cultural context, known as ethnobotany, can be used to develop learning programs that are based on the local environment and culture (Pei et al., 2020). The use of medicinal and cultural plants as learning resources has strategic value because these objects are part of students' daily lives (living wisdom), thus serving as a link between students' prior experiences and the scientific concepts to be learned (Putri et al., 2025). According to Ausubel's theory of meaningful learning, learning is more effective when new information is connected to students' pre-existing knowledge structures (Inanna, 2018). Therefore, local plants can serve as advance organizers, facilitating students' comprehension of abstract concepts like the classification of living organisms through the use of relatable, tangible objects.

By employing an ethnobotanical approach to the study of living organism classification, students are able to directly participate in the scientific process by observing, identifying, categorising, and analysing the characteristics of local plants. Plants such as ginger (Zingiber officinale), turmeric (Curcuma longa), bitter leaf (Andrographis paniculata), croton (Acalypha wilkesiana), betel nut (Areca catechu), and coconut (Cocos nucifera) can be used as learning objects that not only introduce taxonomic concepts but also explore their benefits, cultural values, and the relationship between humans and the environment. This approach can transform classification learning from a rote memorization activity into a contextual scientific investigation experience (Rasmawan et al., 2025).

Several studies have demonstrated the impact of ethnobotany-based instruction on students' scientific literacy. The flexibility of ethnobotany modules and their relevance to students' daily lives make them an effective tool for assessing scientific literacy skills (Rasmawan et al., 2025). Ethnobotany-based storybooks utilizing local plants have the potential to enhance scientific literacy through contextual learning that connects scientific concepts with local wisdom (Halifah et al., 2025). An ethnobotany-based digital teaching module that incorporates Banyuwangi local wisdom was determined to be highly suitable for educational purposes and effective in enhancing scientific literacy, as evidenced by the improved pre- and post-learning test results (Jannah & Viclara, 2025). The utilisation of a local wisdom-based ethnobotany atlas significantly improved students' scientific literacy and was quite effective as an alternative learning resource that connected scientific concepts with the use of local plants (Gayatri et al., 2023). Thus, the aim of this study is to ascertain the impact of ethnobotany-based teaching modules on the scientific literacy skills of junior high school students in the classification of living organisms.

METHOD

The quantitative approach employed in this research was an pre-experimental method that utilised a one-group pretest–posttest design. Seventeen seventh-grade students served as subjects in the study, which was conducted at a junior high school in Biluhu. The aim of this study was to evaluate the enhancement of students' scientific literacy abilities as a result of their involvement in a learning module that was ethnobotany-based and focused on the classification of living organisms. Three stages comprised the research design: a pretest prior to the learning process, a treatment program that implemented an ethnobotany-based learning module that utilised local plants as learning resources, and a posttest subsequent to the completion of all learning activities.

A student response questionnaire and a scientific literacy examination comprised the research instruments. The scientific literacy test was composed of ten multiple-choice questions that were developed in accordance with scientific literacy competency indicators. These indicators include the capacity to scientifically explain phenomena, evaluate and design scientific investigations, and interpret data and evidence. The test instrument was declared valid with a feasibility score of 88.67% after undergoing expert validation. The students' scientific literacy skills were assessed before and after the treatment using the same test.

In order to ascertain students' reactions to the implementation of ethnobotany-based instructional modules, a response questionnaire was implemented. The questionnaire was administered to all students following the final meeting, and they were required to complete it in accordance with the instructions provided. The questionnaire employed a Likert scale with four response alternatives: Strongly Agree – Strongly Disagree. For positive statements, the scores were assigned sequentially as 4, 3, 2, and 1, while for negative statements, the scores were reversed to 1, 2, 3, and 4. The questionnaire scores were then converted to percentages to reflect the level of student response to the learning.

The scientific literacy test data were analyzed using descriptive statistics to determine the mean, standard deviation, and minimum and maximum scores. The Shapiro-Wilk test was used to test for normality, and a paired t-test was used to compare pre- and post-science literacy. Improvements in scientific literacy skills were analyzed using the normalized gain (N-gain) method developed by Hake (1998).

RESULTS AND DISCUSSION

The findings of this investigation provide a comprehensive assessment of the scientific literacy capabilities of seventh-grade junior high school students prior to and following their involvement in a teaching module that is ethnobotany-based and focuses on the classification of living organisms. Based on the results of the initial and final tests, an analysis was conducted to ascertain differences in students' scientific literacy abilities (Figure 1), as well as the magnitude of the increase calculated using N-gain (Figure 2). In addition, the results include students' responses to the use of the ethnobotany-based teaching module as a teaching material that integrates local plants in science learning. These findings are presented through descriptive and statistical analysis (Table 1 and Figure 3) to provide an overview of the improvement in scientific literacy abilities and students' acceptance of the learning that has been implemented.

The average pretest score prior to the lesson was 50.78, whereas the average posttest score increased to 77.65. This represents an average increase of 26.86 points, or approximately 52.90%, compared to the students' initial abilities. The N-Gain calculation based on the class average yielded a value of 0.546, which is considered moderate (Figure 2). These findings suggest that the use of ethnobotany-based modules is accompanied by a growth in students' scientific literacy. This improvement indicates that integrating local knowledge into teaching materials has the potential to help students comprehend scientific concepts through phenomena and experiences relevant to everyday life.

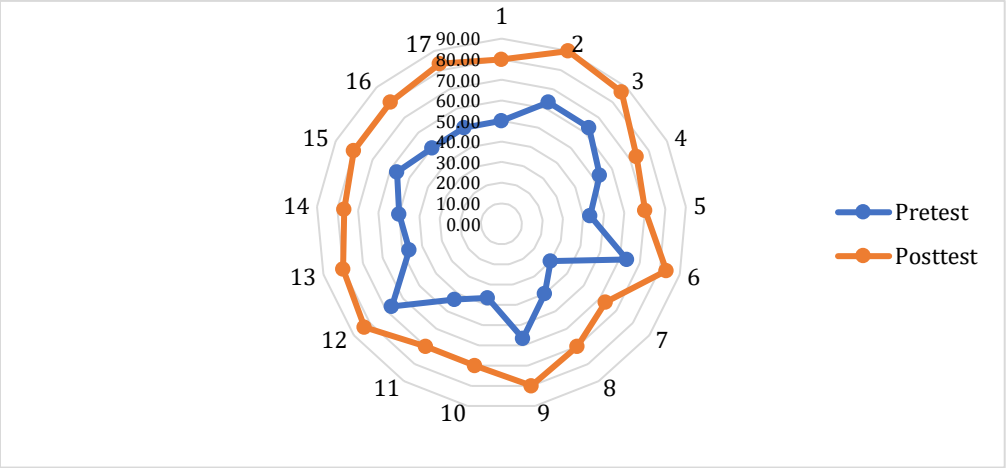


Fig. 1. Student pretest and posttest data

Judging from the changes in individual scores (Figure 2), all students showed improvements in learning outcomes of varying magnitudes. Students with an initial score of 30.00 experienced an increase to 63.33, while students with an initial score of 36.67 increased to 70.00. Meanwhile, students with an initial score of 63.33 were able to achieve a posttest score of 90.00. These findings demonstrate that improvements in scientific literacy skills occurred in students with different levels of initial ability. This indicates that ethnobotany-based modules have the potential to provide learning support for students with both low and high initial abilities. The use of an ethnobotany context allows students to connect traditional knowledge about plants with scientific explanations, making the learning process more contextual and meaningful.

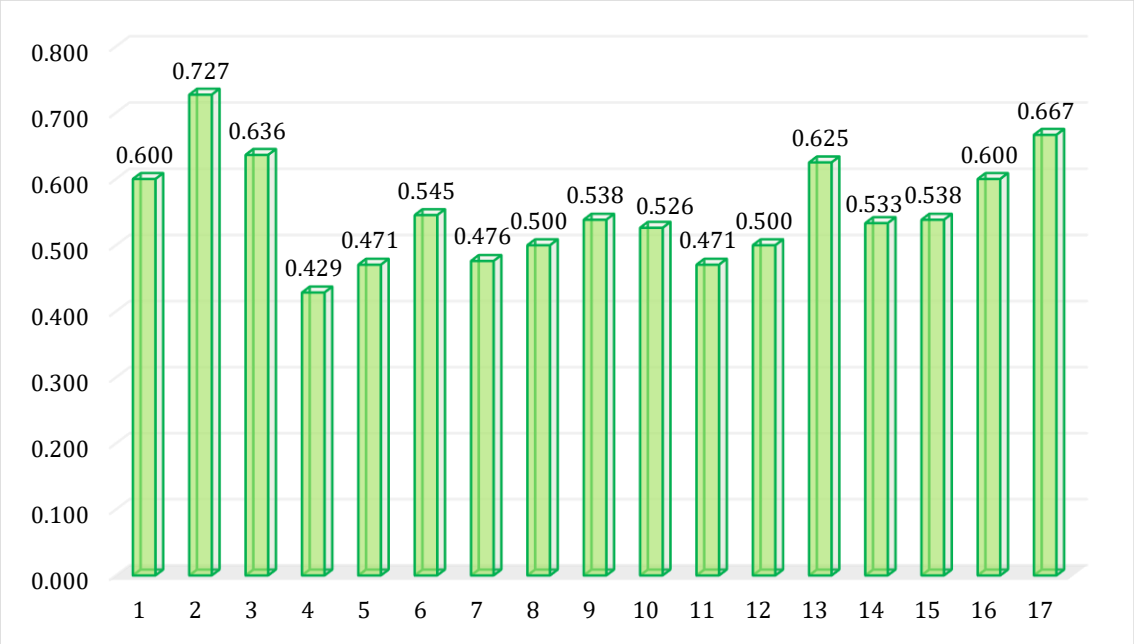


Fig. 2. Student N-gain value

These findings are consistent with the research conducted by Kumalasari et al. (2019), which demonstrated that ethnoscience-based science teaching materials can

enhance students' learning performance. The study found that the use of ethnoscience-based teaching materials resulted in an enhance in learning outcomes, as evidenced by an N-Gain value of 0.648. In addition, Suryanti et al. (2020) discovered that students' scientific literacy was enhanced by local wisdom-based teaching materials, with the N-Gain of 0.50. The N-Gain value of that study (0.546) is in close proximity to the results of this research, which further supports the notion that incorporating local knowledge into teaching modules is a potential strategy for fostering the development of scientific literacy. Students' capacities to interpret scientific data and evidence, evaluate scientific investigations, and explain phenomena scientifically are crucial in a variety of life contexts (Nasir et al., 2024). Consequently, the utilization of ethnobotany-based teaching modules has the potential to serve as an alternative contextual learning approach that establishes a connection between scientific knowledge and the local culture and environment of students.

Table 1. Results of the Shapiro–Wilk and paired sample t-tests

Test Type	Parameter	Pretest	Posttest	Difference
Shapiro–Wilk	N	17	17	17
	W	0.964	0.943	0.926
	Sig. (p)	0.708	0.351	0.184
Paired Sample t-Test	Mean	50.78	77.65	26.86
	t	–	–	–21.299
	df	–	–	16
	Sig. (2-tailed)	–	–	< 0.001

The pretest data (W = 0.964; p = 0.708), posttest (W = 0.943; p = 0.351), and the difference in scores between the two measurements (W = 0.926; p = 0.184) did not exhibit significant deviations from the normal distribution, as indicated by the Shapiro–Wilk test results (Table 1). Consequently, a paired sample t-test was employed to analyse the differences in students' scientific literacy before and after the implementation of ethnobotany-based teaching modules. The findings indicated that the students' scientific literacy significantly improved following the implementation of ethnobotany-based teaching modules that utilised local flora as learning resources. The posttest resulted in an average increase of 77.65 points from the pretest score of 50.78, as indicated by the paired sample t-test results of 17 students. This represents an average difference of 26.86 points. The test results revealed a t(16) value of -21.299 with $p < 0.001$, suggesting a substantial disparity between the scientific literacy skills of students prior to and following the module's implementation. This finding provides empirical evidence that learning using ethnobotany-based modules is associated with improved students' ability to understand and use scientific knowledge. These findings are consistent with the findings of Hadiprayitno et al. (2024), who have shown that context-based learning can facilitate the development of scientific literacy. Moreover, Luzyawati et al. (2026) noted that the integration of local knowledge with learning activities has the possibility of improving scientific literacy through ethnobiology-based learning. The relevance of utilizing local flora as a scientific learning context that is in close proximity to the lives of junior high school students is further emphasized by this alignment of results.

The integration of local plants as learning objects that connect biological concepts with students' everyday knowledge and experiences is the key to understanding the improvement in scientific literacy that occurs after the use of ethnobotany-based learning modules. Plants growing in the surrounding environment not only serve as examples of biodiversity but also serve as sources of information for studying morphological characteristics, the structure and function of plant organs, adaptation, and the relationship between plants and the environment (Damopolii et al., 2019). Through ethnobotany-based learning modules, students have the opportunity to connect community knowledge regarding local names, characteristics, and uses of plants with scientific concepts learned in school. Lestari et al. (2024) demonstrated that integrating ethnobotany into learning has the potential to develop environmental literacy through investigative activities involving plants of community value. Meanwhile, Gani et al. (2024) demonstrated that project-based ethnobotany learning can be used to develop literacy through the exploration of plant knowledge. Both studies support the use of local plants as learning resources, enabling students to connect traditional knowledge with scientific explanations. In this study, the enhance in scientific literacy scores indicates that modules utilizing local plants have the potential to help students understand biology material more contextually.

The use of local plants in ethnobotany-based learning modules also provides opportunities for junior high school students to develop their ability to explain phenomena scientifically. When studying plants familiar to them in everyday life, students can be guided to identify plant characteristics, explain the relationship between organ structure and function, and analyze the scientific rationale behind plant use by local communities. This process helps connect empirical knowledge gained from the local environment and culture with formally learned biological concepts. Verawati and Wahyudi (2024) emphasize the relevance of integrating local wisdom into learning to support students' scientific literacy. Furthermore, Supriatna et al. (2025) identified that ethnoscience-integrated science modules have the potential to strengthen mastery of scientific concepts through the use of cultural contexts close to students' experiences. These findings provide a basis for understanding the improvement in scientific literacy skills in this study as consistent with learning that uses local plants to bridge students' prior knowledge with biological concepts.

Ethnobotany-based learning modules enable students to develop their ability to identify scientific problems and interpret evidence through exploration of local plants. Observing differences in leaf shape, stems, roots, habitats, and plant uses can provide a basis for students to formulate questions, compare characteristics, and construct explanations based on their observations. These activities are essential for junior high school science education, as scientific literacy is not only associated with the acquisition of factual knowledge but also with the capacity to employ evidence to elucidate natural phenomena. Direct observation of local plants as a contextual learning resource supports the ability to identify characteristics, construct scientific descriptions, and interpret evidence (Horota et al., 2023; Wambrauw et al., 2025), all components of scientific literacy (Musyarofah et al., 2025). In the context of this study, the use of local plants as objects of investigation provided an opportunity for students to connect observations with scientific concepts. Therefore, the increase in posttest scores can be understood as a finding consistent with the characteristics of learning that involves direct exploration of biological objects, although the contribution of each activity has not been tested separately.

The use of ethnobotany-based learning modules is particularly relevant for junior high school science learning because students are at the stage of developing the ability to connect concrete observations with more complex scientific explanations. Local plants found in school and residential environments provide easily recognizable learning objects and allow students to directly observe biological phenomena. Utilizing these objects can reduce the reliance on abstract examples presented solely in textbooks. Silahooy et al. (2024) demonstrated the importance of utilizing local context in science learning, while Cahyani et al. (2026) highlighted the potential for integrated learning with local plants to strengthen students' scientific literacy. Similarly, Hernawati et al. (2019) provided evidence of the relevance of contextual learning through local plant diversity for the development of students' scientific literacy. In this study, the significant improvement in scientific literacy skills after using the module indicates that utilizing local plants is a promising approach for connecting junior high school science learning with students' environments and life experiences.

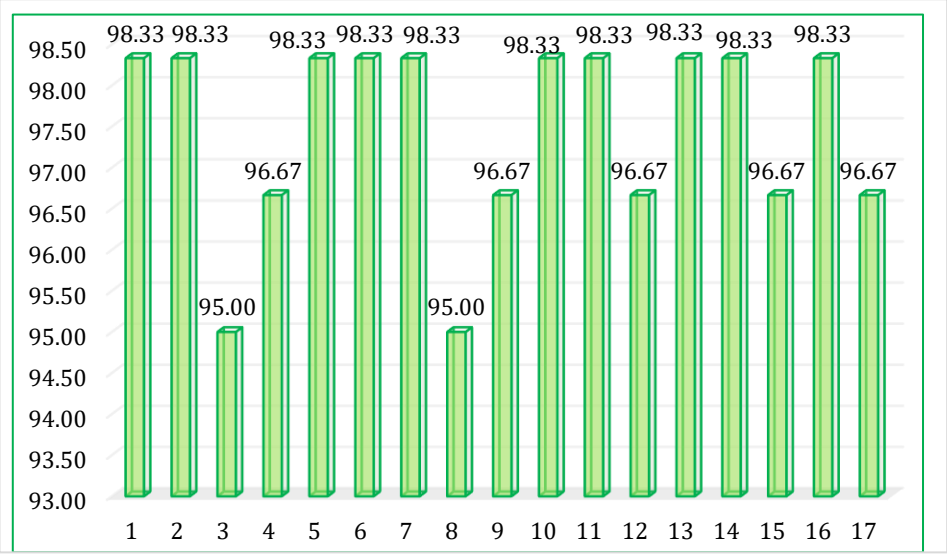


Fig. 3. Student response to learning

The results of the questionnaire response analysis of 17 students (Figure 3) indicate that learning using the ethnobotany-based learning module received a very positive response, with an average percentage of 97.45%. Student response scores ranged from 95.00% to 98.33%. Ten students (58.82%) achieved a response score of 98.33%, five students (29.41%) achieved a score of 96.67%, and two students (11.76%) achieved a score of 95.00%. These high response percentages indicate that the ethnobotany-based learning module, which utilizes local plants, has received a very good level of acceptance from junior high school students. The positive student response to the ethnobotany-based learning module is thought to be related to the contextual presentation of the material through the use of local plants familiar to them. The use of objects familiar to students allows biological concepts to be learned through everyday experiences and direct observation, making the material easier to understand and more relevant to the surrounding environment.

These findings align with those of Rofi'i et al. (2022), who reported that ethnobotany-based electronic modules utilizing local wisdom from Lombok received positive responses

from students and were considered easy to use in biology learning. Furthermore, Ernawati et al. (2021) found that a biology module based on local community ethnobotany achieved an ease-of-use rating of 97.5%, demonstrating the relevance of utilizing local plants in developing teaching materials. Thus, the high student response in this study reinforces the indication that ethnobotany-based teaching modules are well-received as learning resources that connect science concepts with local plants and community knowledge, while also providing initial support for their ease of use in junior high school science learning. Therefore, the very positive student responses can be seen as an indication that the ethnobotany approach is accepted as a learning context that supports student engagement in scientific literacy activities.

CONCLUSION

The study's findings suggest that the scientific literacy skills of seventh-grade junior high school students are positively impacted by the use of ethnobotany-based teaching modules on the classification of living things. After learning, the improvement in scientific literacy skills suggests that the utilisation of local plants as a learning resource has the potential to assist students in comprehending biological concepts and connecting them to everyday phenomena. Furthermore, the extremely favourable student responses suggest that ethnobotany-based teaching modules can be well-received as contextual teaching materials. Consequently, ethnobotany-based teaching modules can serve as an alternative educational resource in the field of science instruction, thereby fostering the growth of scientific literacy among junior high school students.

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