BIO-EDU: JURNAL PENDIDIKAN BIOLOGI
Available in https://jurnal.unimor.ac.id/JBE/index
2026, Vol. 11, Issue. 2, pp 139-146, e-ISSN: 2527-6999
https://doi.org/10.32938/jbe.v11i2.10002

Analysis of Botanical Literacy Levels Among Senior High School Students in Urban Schools

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Article Information
Received: 2025-07-05
Revised: 2026-08-13
Accepted: 2026-08-15
Published: 2026-08-30

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Abstract

This study aims to analyze the level of botanical literacy among 11th-grade students at SMAN 15 Jakarta. The research employed a survey method using a questionnaire instrument distributed via Google Form, involving 56 students (25 male and 31 female) who had studied botany material within the Biology curriculum. The data were analyzed using a descriptive qualitative approach by classifying scores into botanical literacy categories, calculating frequencies and percentages, and analyzing the relationships between each question indicator to determine the students' level of botanical literacy. The results showed that 15 students (26.79%) were in the Very Low category, 3 students (5.36%) in the Low category, 16 students (28.57%) in the Fair category, 18 students (32.14%) in the High category, and 4 students (7.14%) in the Very High category. Based on the indicators, the General Characteristics of Plants indicator obtained the highest average score (78.57), while the Plant Identification indicator received the lowest average score (28.57). These findings indicate that students have a better understanding of basic plant concepts than the ability to identify plants directly. This research provides an overview of the variation in students' botanical literacy levels and can serve as a foundation for developing more contextual and applicative Biology learning models to enhance comprehension, particularly in the aspects of plant identification and classification.

Keywords: *Botanical literacy; Biology learning; Plant identification; High school students; Educational survey*

Abstrak

Penelitian ini bertujuan untuk menganalisis tingkat literasi botani siswa kelas XI SMAN 15 Jakarta. Penelitian ini menggunakan metode survei dengan instrumen kuesioner berbasis Google Form yang diikuti oleh 56 siswa SMA (25 laki-laki dan 31 perempuan) yang telah mempelajari materi botani. Data dianalisis secara deskriptif kualitatif melalui klasifikasi skor, perhitungan frekuensi dan persentase, serta analisis hubungan antar indikator soal untuk mengetahui tingkat literasi botani peserta didik. Hasil penelitian menunjukkan bahwa 15 siswa (26,79%) berada pada kategori Sangat Rendah, 3 siswa (5,36%) kategori Rendah, 16 siswa (28,57%) kategori Cukup, 18 siswa (32,14%) kategori Tinggi, dan 4 siswa (7,14%) kategori Sangat Tinggi. Berdasarkan indikator soal, indikator Ciri-ciri umum tumbuhan memiliki rata-rata tertinggi (78,57), sedangkan indikator Identifikasi tumbuhan terendah (28,57). Hal ini menunjukkan siswa lebih memahami Konsep dasar tumbuhan dibandingkan kemampuan mengidentifikasi tumbuhan secara langsung. Hasil penelitian ini memberikan gambaran variasi tingkat literasi botani siswa serta dapat menjadi dasar pengembangan model pembelajaran Biologi yang lebih kontekstual dan aplikatif untuk meningkatkan pemahaman, khususnya pada aspek identifikasi dan klasifikasi tumbuhan.

Kata Kunci: *Literasi botani; Pembelajaran biologi; Identifikasi tumbuhan; Siswa SMA; Survei pendidikan*

1. INTRODUCTION

Biology education at the senior high school (SMA) level plays a strategic role in shaping students' understanding and awareness of the importance of environmental sustainability. One of the key aspects of the Biology curriculum is botany, which is the branch of science that studies the

structure, function, classification, and roles of plants in life. Botany not only provides a foundation for understanding ecosystem processes but also contributes directly to addressing global issues such as food crises, climate change, and public health. Students' understanding of botany serves as a foundation for developing comprehensive and sustainable ecological literacy (Indah & Fadilah, 2024).

In the context of Urban Biology, understanding botany has become increasingly relevant. Schools in urban areas generally have limited access to green spaces, resulting in students having fewer opportunities to interact directly with plants in their daily lives. Safrina *et al.* (2022) found that students in urban areas experienced difficulties in identifying practical materials because their surroundings were dominated by vehicles and buildings rather than green spaces. Additionally, Pratama *et al.* (2022) noted that Biology learning in urban schools is highly dependent on internet-based media, with limited opportunities for field activities and direct observation. This condition further exacerbates the phenomenon of plant blindness, which refers to a lack of awareness of the presence and important roles of plants and is often observed in traditional botany learning. Consistent with these findings, Husamah *et al.* (2025), through a global bibliometric analysis, also reported that students' level of botanical literacy remains relatively low. The main factors contributing to this condition include students' low interest in plants, a lack of contextualization in learning materials, and ineffective teaching methods for connecting botanical concepts with the realities of the surrounding environment.

Good botanical literacy is essential for developing a generation of students who not only understand the theoretical aspects of plants but are also able to apply this knowledge in environmental and social contexts. Data from the Programme for International Student Assessment (PISA) indicate that Indonesian students' scientific literacy remains relatively low, with an average score of 396 compared to the international average of 500, highlighting the need to improve scientific literacy comprehensively, including in the field of botany (Kristyowati & Purwanto, 2019). This condition serves as an important indication that botanical literacy should be one of the main focuses in improving national science competencies, particularly in urban areas, which increasingly dominate the educational landscape. The integration of an Urban Biology approach, which emphasizes the use of students' surrounding environmental contexts, with botanical learning is considered an effective strategy for addressing this literacy gap. Daniel *et al.* (2023) demonstrated that integrating urban botanical gardens into learning activities can enhance students' awareness, motivation, and concern for plant conservation in their surrounding environment.

In general, botanical literacy encompasses not only a theoretical understanding of plant structure and function but also students' ability to recognize plant species, understand their ecological and economic benefits, and relate the roles of plants to real-life contexts. Students' limited ability to identify and classify plants is one of the challenges frequently encountered in the field. Limited learning media, insufficient exploration of the surrounding environment, and a lack of direct observation activities further exacerbate this condition (Munif *et al.*, 2019). Therefore, it is important to examine more deeply the current level of students' botanical literacy and identify the aspects that need to be improved so that botanical learning can be more effective, contextual, and applicable in both urban and suburban environments.

Based on these concerns, this study aims to analyze the level of botanical literacy among Grade 11 students at SMAN 15 Jakarta. This study is expected to provide a comprehensive overview of the extent to which students understand botanical concepts, the factors influencing their botanical literacy, and recommendations for learning strategies that can improve botanical literacy at the secondary education level.

2. METHOD

2.1. Research Design

This study employed a descriptive research design using a qualitative approach, which aimed to gain an understanding of events or phenomena and describe them according to the

actual conditions in the field (Suhadi *et al.*, 2023). The study also used a survey method with a quantitative descriptive approach (Muchlis, 2023). The survey method was used to obtain data on the level of botanical literacy among Grade 11 students at SMAN 15 Jakarta by administering an instrument to the respondents. The data obtained were used to describe students' understanding of botanical concepts and the learning conditions related to botanical literacy. Through this method, an overview of the level of botanical literacy among Grade 11 students at SMAN 15 Jakarta was obtained.

2.2. Population and Sample

The population in this study consisted of all Grade 11 students at SMAN 15 Jakarta, totaling 56 students. Since the population size was less than 100, all members of the population were included as the research sample. The sampling technique used was total sampling, which is a sampling technique that involves all members of the population as the research sample (Priatna, 2017). Thus, the research sample consisted of 56 Grade 11 students at SMAN 15 Jakarta, all of whom participated as respondents in the study.

2.3. Research Prosedure

The research procedure was carried out through several stages. The first stage involved conducting an initial observation of the SMAN 15 Jakarta school environment to identify the conditions of the school environment and the characteristics of Biology learning related to botanical topics. The second stage involved determining Grade 11 students as research respondents in accordance with the predetermined research objectives. The third stage consisted of preparing a botanical literacy test instrument covering six indicators: general characteristics of plants, plant identification, plant benefits, plant classification, plant organ structure, and the role of plants in ecosystems. The fourth stage involved collecting data by distributing the instrument to 56 students through Google Forms. The fifth stage involved processing the students' responses by assigning scores to each answer and categorizing them based on their level of botanical literacy (Ayuningrum *et al.*, 2025). The final stage involved analyzing the data based on the frequency, percentage, and average score for each indicator to obtain an overview of the botanical literacy level of Grade 11 students at SMAN 15 Jakarta. The flow of this research procedure is summarized in Figure 1 below.

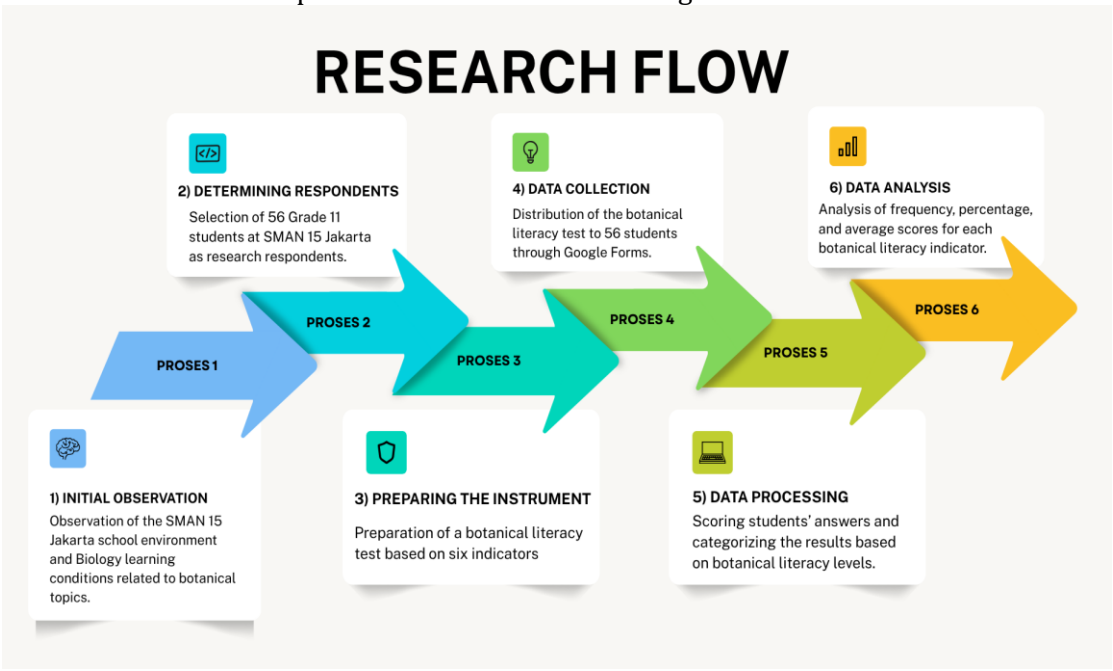

Figure 1. Research flow (Source: Personal Documentation)

2.4. Instrument Research

The data collection technique used in this study was a test instrument in the form of a botanical literacy test questionnaire. The instrument was developed based on botanical literacy indicators and adapted from an instrument developed by Novianti (2025) in a study entitled *"Pengembangan Instrumen Tes Literasi Botani untuk Peserta Didik SMA"* [Development of a Botanical Literacy Test Instrument for Senior High School Students]. The questionnaire consisted of 15 multiple-choice questions and other question types designed to measure students' understanding of botanical concepts based on six indicators: general characteristics of plants, plant identification, plant benefits, plant classification, plant organ structure, and the role of plants in ecosystems. The questionnaire was administered through Google Forms and completed by all research respondents. The responses were subsequently scored and used to determine the students' botanical literacy level category.

2.5. Data Analysis

The data analysis technique used in this study was quantitative descriptive analysis based on the results of the questionnaire completed by the students. The collected data were analyzed by calculating the scores obtained for each item, which were then converted into percentages using the following formula:

$$NP = \frac{R}{SM} \times 100\%$$

Figure 2. Percentage Value Formula (Source: Rinata *et al.*, 2023)

Description: P = Percentage score obtained
R = Score obtained by the student
SM = Maximum score

The percentage results obtained were then classified into five categories of botanical literacy levels. Scores with a percentage of <20% were categorized as very low, percentages of 21%–40% as low, 41%–60% as moderate, 61%–80% as high, and 81%–100% as very high. This classification was used to determine the students' botanical literacy levels based on the percentage of scores obtained from the questionnaire responses.

3. RESULT AND DISCUSSION

The results of this study were obtained using a descriptive qualitative approach based on responses to a Google Forms questionnaire completed by 56 Grade 11 students at SMAN 15 Jakarta, consisting of 25 male students and 31 female students. All respondents had studied botanical concepts as part of the Biology curriculum and had responded to a series of questions designed to measure their level of botanical literacy. The questionnaire instrument was developed based on six main indicators of botanical literacy, covering aspects ranging from conceptual knowledge to basic scientific thinking skills (Novianti, 2025).

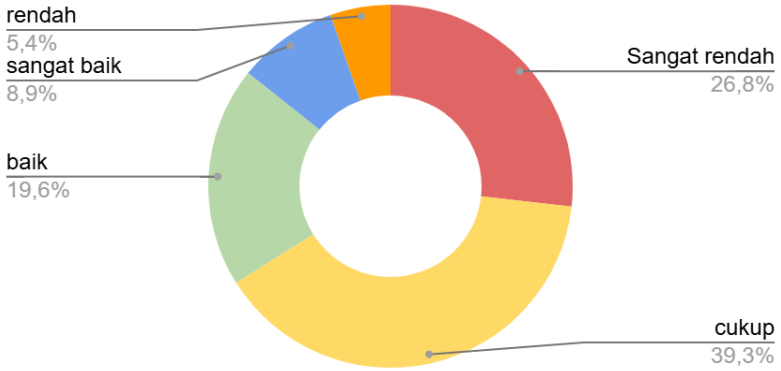

Figure 3. Distribution Diagram of the Botanical Literacy Levels of Grade 11 Students at SMAN 15 Jakarta (Source: Personal Documentation)

Based on the data tabulation, the distribution of students' botanical literacy levels was found to be spread across five categories. A total of 15 students (26.79%) were classified as having a very low level of botanical literacy, 3 students (5.36%) as low, 16 students (28.57%) as moderate, 18 students (32.14%) as high, and 4 students (7.14%) as very high. These findings indicate that most students had moderate to high levels of botanical literacy (60.71%); however, a significant proportion (32.15%) remained in the low and very low categories. This disparity highlights the need for a more adaptive learning approach, particularly for students who have not yet developed a deep understanding of botanical concepts (Safrina *et al.*, 2022).

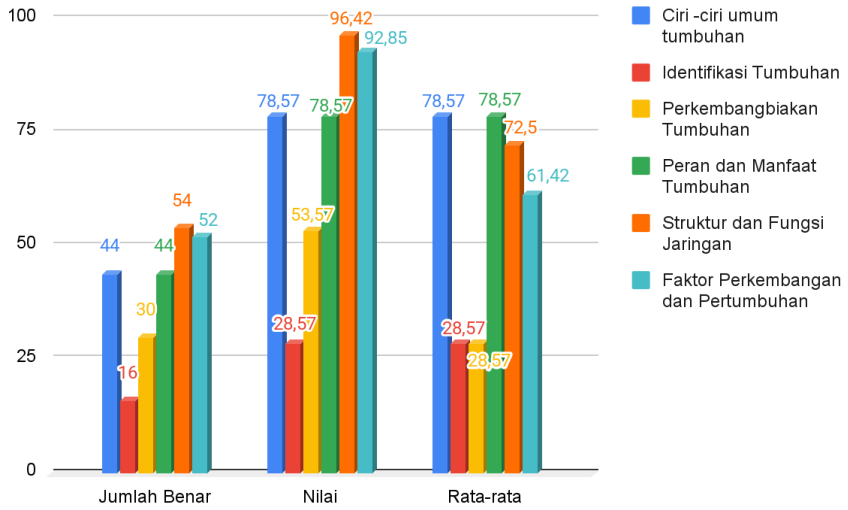

Figure 4. Graph of Average Botanical Literacy Scores Based on Question Indicators (Source: Personal Documentation)

Furthermore, an analysis based on the six question indicators revealed differences in achievement across the various aspects of botanical literacy. Based on the number of correct answers, the Structure and Function of Tissues indicator had the highest number of correct responses, with 54 answers, followed by the Development and Growth Factors indicator with 52 correct answers. The high number of correct answers for these two indicators was also reflected in their respective scores of 96.42 and 92.85. However, these scores do not directly indicate that the two indicators had the highest average achievement, as the values shown in the graph represent the percentage of correct answers, whereas the average reflects overall achievement for each indicator based on the scoring calculation used in this study. Therefore, differences between the scores and averages may occur because they represent different aspects of measurement. The General Characteristics of Plants indicator obtained the highest average score

of 78.57 and was categorized as high. This result indicates that students were relatively more capable of understanding the basic characteristics of plants compared to several other aspects. Meanwhile, the Role and Benefits of Plants indicator also showed a relatively high achievement, with a score of 78.57, whereas Plant Identification was the indicator with the lowest achievement, at 28.57. Overall, these findings indicate that students performed better in understanding basic concepts and plant functions, while their abilities related to plant identification and the application of botanical knowledge still need to be improved.

In contrast, the "Plant Identification" indicator showed a low result, with an average score of 28.57 (low category). This finding indicates that students experienced difficulties in recognizing and classifying various plant species based on their morphological or taxonomic characteristics. This finding is consistent with the study by Maskour *et al.*, (2016), which revealed that students in urban areas experienced difficulties in recognizing and classifying various plant species due to limited access to direct field-based learning experiences. The lack of practical activities, environmental exploration, and access to real specimen-based learning media contributes to weak plant identification and classification skills in urban schools. Other indicators, such as "Plant Classification," "Plant Organ Structure," and "The Role of Plants in Ecosystems," also showed varying levels of achievement, indicating the need for further strengthening of students' systematic and applied thinking skills (Hidayah *et al.*, 2018).

The disparity in scores across the indicators suggests that current learning approaches may still place greater emphasis on declarative aspects (memorized knowledge) rather than procedural aspects (hands-on practice). This condition is further exacerbated by the phenomenon of plant blindness, which refers to a low level of awareness of the presence and important roles of plants in ecosystems and often occurs in urban environments due to limited green spaces (Daniel *et al.*, 2023). According to Husamah *et al.* (2025), low botanical literacy in Indonesia is influenced by learning materials that lack contextualization, students' low interest in plants, and teaching methods that have not yet effectively connected botanical concepts with the conditions of the surrounding environment.

Therefore, more contextual and environment-based learning innovations are needed, such as direct observation activities, the creation of simple herbaria, or the use of school gardens as learning media for botany. Darmoatmodjo *et al.* (2024) stated that integrating school botanical gardens, urban gardens, and environmental observation activities around the school can increase students' ecological awareness and motivation to conserve plants. Hernawati *et al.* (2022) further emphasized that outdoor learning can strengthen scientific thinking skills and significantly improve botanical literacy in urban environments.

Furthermore, research by Rizkamariana *et al.* (2019) demonstrated that an environment-based *Project-Based Learning* (PjBL) approach is effective in improving students' plant identification and classification skills. Meanwhile, the use of mobile learning-based plant identification applications, which have not yet been widely adopted in urban schools, has also been shown to support students' taxonomic skills in a practical and efficient manner (Amizera *et al.*, 2022). In addition, Krosnick *et al.* (2018) demonstrated that simple programs, such as growing and caring for *pet plants*, can significantly reduce plant blindness among urban students.

Thus, the results of this study provide a comprehensive overview of the variation in students' botanical literacy levels and the aspects that need to be improved. Biology teachers are expected to use these findings as a basis for decision-making in lesson planning, particularly in developing activities that enhance students' skills in plant identification, classification, and direct observation. Adjusting teaching methods and learning media to be more interactive and exploratory is a strategic step toward improving the quality of botanical literacy more evenly among students.

4. CONCLUSION

Based on the research findings, the botanical literacy levels of Grade 11 students at SMAN 15 Jakarta varied from very low to very high. The General Characteristics of Plants indicator

obtained the highest average score of 78.57, which was categorized as high, while the Plant Identification indicator obtained the lowest average score of 28.57, which was categorized as low. These results indicate that students had a better understanding of basic plant concepts than their ability to identify plants directly.

5. ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to Mr. Rizhal Hendi Ristanto and Mr. Ade Suryanda, who served as academic supervisors, for their guidance, support, and valuable feedback throughout the research process and the preparation of this article. The authors would also like to thank all friends who assisted with data collection and the implementation of the research, making it possible for this study to be carried out successfully.

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