Bioscientist: Jurnal Ilmiah Biologi
https://e-journal.undikma.ac.id/index.php/bioscientist

September 2026 Vol. 14, No. 3
e-ISSN: 2654-4571
pp. 1161-1176

Plant Species Inventory at SMP Negeri 2 Lakea, Buol Regency, and Their Utilization as Learning Media

[1]Nurhidayah, [2*]Musdalifa Nurdin, [3]Lilies, [4]Aan Febriawan, [5]Vita Indri Febriani, [6]Lestari M.P Alibasyah

[1,2,3,4,5,6]Department of Biology Education, Faculty of Teacher Training and Education, Universitas Tadulako, Palu, Indonesia.

*Corresponding Author e-mail: ifah_nurdin@yahoo.com

Received: June 2026; Revised: July 2026; Accepted: August 2026; Published: September 2026

Abstract: This study aimed to identify and describe the plant species found on the grounds of SMP Negeri 2 Lakea, Buol Regency, and to develop a digital pocketbook in flipbook format as a contextual learning medium based on local biological resources. An exploratory descriptive method was employed, combining qualitative analysis for plant identification with descriptive quantitative analysis for media validation. Data were collected through surveys and systematic field exploration, direct observation, documentation, and plant identification based on morphological characteristics using relevant literature. The developed medium was validated by content, media, and instructional design experts and evaluated through responses from 30 seventh-grade students at SMP Negeri 2 Lakea. The study identified 35 plant species belonging to 20 families and representing four growth forms: herbs, shrubs, bushes, and trees. The recorded species included ornamental, medicinal, and shade plants, as well as naturally occurring wild species. These findings indicate that the school environment has substantial biological resource potential that can be utilized as a contextual learning resource. Based on student responses, the digital pocketbook was considered practical, concise, interactive, and helpful for understanding the learning material. The feasibility assessment yielded scores of 80% from the content expert, 83% from the media expert, 87% from the design expert, and 91% from student responses. The overall mean score was 85%, placing the medium in the highly feasible category. Therefore, the digital pocketbook based on plant diversity at SMP Negeri 2 Lakea is suitable for use as a contextual learning medium integrating local biological potential.

Keywords: Plant diversity; SMP Negeri 2 Lakea; digital pocketbook; contextual learning media

How to Cite: Nurhidayah, Nurdin, M., Lilies, Febriawan, A., Febriani, V. I., & Alibasyah, L. M. (2026). Plant Species Inventory at SMP Negeri 2 Lakea, Buol Regency, and Their Utilization as Learning Media. *Bioscientist: Jurnal Ilmiah Biologi*, *14*(3), 1161–1176. https://doi.org/10.33394/bioscientist.v14i3.20972

https://doi.org/10.33394/bioscientist.v14i3.20972

INTRODUCTION

Indonesia is recognized as one of the world's megadiverse countries and possesses exceptionally rich floral diversity. Its tropical location, archipelagic geography, and varied environmental conditions have contributed to the formation of diverse ecosystems that support substantial plant diversity (Supriatna, 2018). This biological richness is not only ecologically important but also represents a valuable resource for education, research, conservation, and sustainable development. Integrating biodiversity into educational programs is essential for strengthening students' knowledge, awareness, and responsibility toward the sustainable use and conservation of biological resources (UNESCO, 2026). In science education, local plant diversity can therefore serve as an authentic learning resource for topics such as the classification of living organisms, biodiversity, plant morphology, ecological interactions, and ecosystems.

Plants perform essential ecological and socioeconomic functions, including producing oxygen, supplying food and medicinal materials, providing shade and ornamental value, and maintaining environmental balance. Therefore, students should be introduced to plant diversity from an early stage through contextual learning experiences that are closely connected to their surroundings (Naisila et al., 2024).

Place-based education emphasizes the use of local environments, experiences, and community contexts to make academic content more relevant and meaningful to learners (Yemini et al., 2025). Linking science instruction to students' local contexts may also promote engagement, authentic observation, and the application of scientific concepts to real-world conditions (Holmes et al., 2021). In this context, school grounds represent an accessible learning environment because they contain biological objects that students can directly and repeatedly observe without requiring extensive field trips or additional resources.

SMP Negeri 2 Lakea has relatively diverse vegetation, including herbs, shrubs, small woody plants, and trees. Within its 4,950 m² grounds, various wild plants grow naturally, whereas others are deliberately cultivated as ornamental, food, medicinal, or shade plants. However, preliminary observations and interviews with science teachers indicated that these plants have not been optimally utilized as learning resources. Instruction on the classification of living organisms and biodiversity remains largely dependent on textbooks. Consequently, students have limited opportunities to recognize the plants in their immediate environment, including their local and scientific names, morphological characteristics, growth forms, uses, and taxonomic classifications. This reliance on textbook-based instruction may restrict students' ability to connect abstract biological concepts with organisms that they encounter in everyday life. Furthermore, no locally based learning medium is currently available that documents and presents information on the plant species found at SMP Negeri 2 Lakea.

Several previous studies have inventoried plant species in educational environments. Juheti (2018) reported 91 plant species belonging to 38 families on the Tadulako University campus, whereas Tira Elovani (2022) identified 54 plant species at SMA Negeri 1 Sindue. Wahyudi (2020) also conducted a plant inventory at SMP Negeri 11 Sungai Penuh. These studies demonstrate that school grounds and other educational institutions may contain considerable plant diversity that can be utilized as a learning resource. Learning science through gardens and other nearby natural environments can provide opportunities to connect biological concepts with direct experience and locally observable phenomena (Lloyd & Paige, 2022). Nevertheless, plant inventories alone do not ensure that the resulting scientific information is accessible or pedagogically useful to students. The inventory data must be systematically organized and transformed into an appropriate learning resource that aligns with students' characteristics and curricular needs.

To the best of the authors' knowledge, no previous study has systematically identified and documented the plant species at SMP Negeri 2 Lakea or integrated the resulting inventory into a digital learning medium. Accordingly, the present study addresses two interconnected gaps. The first is a scientific documentation gap concerning the composition and morphological characteristics of plant species within the school grounds. The second is an educational gap arising from the absence of contextual learning media that use locally available plants to support science instruction. The integration of local environmental resources into learning can make scientific concepts more contextual, relevant, and meaningful to students while strengthening the relationship between schools and their surrounding environments (Holmes et al., 2021; Yemini et al., 2025).

A digital pocketbook in flipbook format offers a potential means of transforming plant inventory data into an accessible learning resource. A flipbook can present information concisely and visually through text, photographs, illustrations, and interactive navigation. When appropriately designed, digital flipbooks can

accommodate scientific names, taxonomic information, morphological descriptions, plant uses, and photographic documentation within a portable medium that can be accessed through computers or mobile devices. A systematic literature review of flipbook implementation in science education reported that this medium can support student engagement, motivation, digital literacy, and learning outcomes by integrating visual and multimedia elements into instructional materials (Unayah et al., 2024). However, the educational value of a flipbook depends on the scientific accuracy of its content, the clarity of its presentation, its technical usability, and its relevance to learners' local context. Expert validation and student responses are therefore necessary before the medium can be recommended for classroom use.

Previous studies have also reported that flipbook-based learning media can support students' motivation, conceptual understanding, participation, and learning outcomes in science and biology education (Rahayu et al., 2021; Wahyuni & Lestari, 2023). Nevertheless, many digital flipbooks present general curricular content and are not specifically based on organisms found in students' immediate school environment. The novelty of the present study therefore lies in combining a systematic inventory of local plant diversity with the development of a contextual digital pocketbook specifically designed for students at SMP Negeri 2 Lakea. Through this integration, students can learn plant classification and diversity not only as abstract concepts but also by directly recognizing species that occur within their own school grounds.

This study aimed to: (1) identify, document, and describe the plant species found at SMP Negeri 2 Lakea based on their morphological characteristics and taxonomic classifications; and (2) develop and evaluate the feasibility of a digital pocketbook in flipbook format based on the local plant inventory as a contextual science learning medium. The study is expected to provide baseline scientific information on plant diversity within the school environment and to produce a locally relevant digital resource that supports the teaching of biodiversity, plant morphology, and biological classification. This objective is consistent with Tjitrosoepomo (2017), who emphasized that plant identification and classification based on morphological characteristics are fundamental components of taxonomy for recognizing similarities, differences, and relationships among plants.

METHOD

This study employed a descriptive research design with a qualitative approach to identify and describe the plant species found within the grounds of SMP Negeri 2 Lakea. The plant inventory was subsequently used to develop a digital pocketbook in flipbook format as a science learning medium. The study was conducted at SMP Negeri 2 Lakea, located on Trans Sulawesi Road, Lakuan Buol Village, Lakea District, Buol Regency, Central Sulawesi Province, Indonesia. The research commenced in January 2026 and continued until all research activities were completed. Field observations were conducted during the dry season through three survey visits to obtain more representative data on the plant species present in the school environment. The location of the study site is presented in Figure 1.

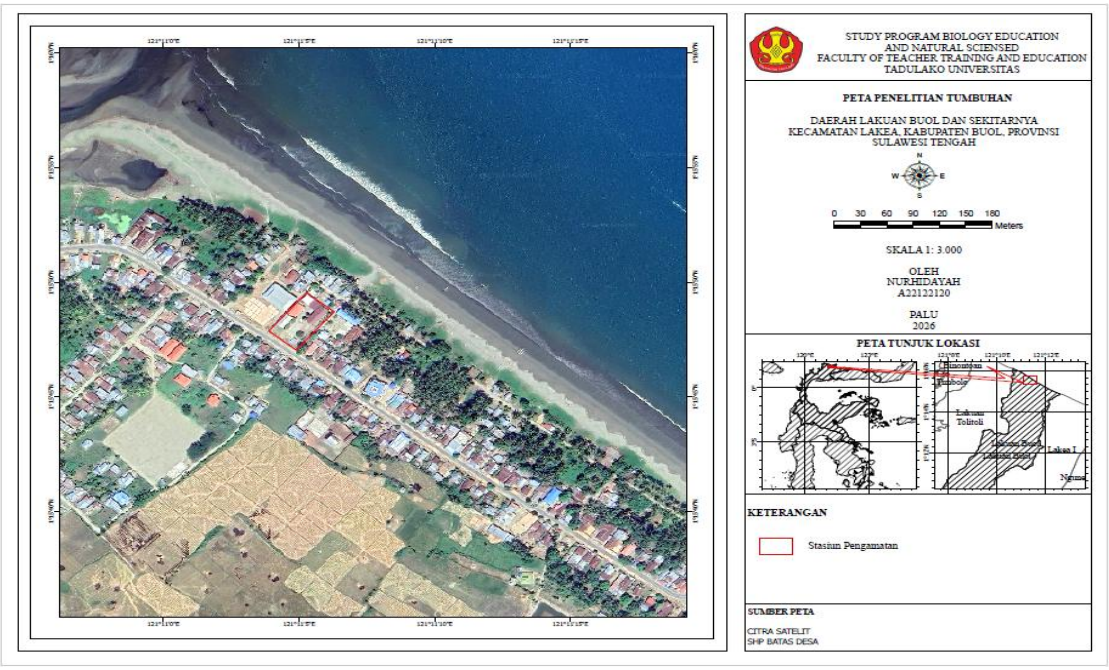


Figure 1. Research location

The research objects comprised all plant species found within the school grounds, including intentionally cultivated plants and species growing naturally. The plant inventory was conducted using a survey method combined with a systematic field exploration technique (*cruise method*). The exploration was carried out by surveying the entire school area from the front to the rear sections. The observation areas included the school's front yard, gardens and areas surrounding the classrooms, the school field, open spaces, areas along the school fence, and the rear section of the school grounds.

All plant species encountered in each observation area were directly examined. The data were recorded by species rather than by the number of individual plants. Each species was photographed using a camera, and its morphological characteristics were documented, including the roots, stems, leaves, flowers, fruits, and seeds, when available.

Plant identification was conducted to the species level whenever possible using plant identification books, taxonomic literature, scientific articles, and other relevant references. Scientific names were determined by comparing the observed morphological characteristics with the descriptions provided in the identification references. Plant growth forms were classified according to Tjitrosoepomo (2017). Herbs were defined as plants with soft, non-woody stems; semak as woody plants branching from the base of the stem; perdu as woody plants with a short main stem and numerous branches; and trees as relatively large woody plants with a clearly defined main trunk. The Indonesian growth-form categories were retained to ensure consistency with the classification used throughout the study.

The plant inventory data were then used as the basis for developing a digital pocketbook in flipbook format. The learning medium was created using Canva. The flipbook contained photographs of the plants, local names, scientific names, families, growth forms, morphological characteristics, plant uses, and the locations where each species was found within the school environment. The material was presented in a concise and visually engaging format by integrating text and images to facilitate student understanding.

The feasibility of the digital pocketbook was evaluated by three university lecturers serving as validators: one content expert, one media expert, and one instructional design expert. The validators were selected based on their competencies and expertise in their respective fields, enabling them to assess the quality of the developed learning medium.

The content expert evaluated the alignment of the material with junior high school science learning outcomes, the accuracy of plant classification, the completeness of the information, the appropriate use of scientific terminology, and the clarity of the language. The media expert assessed ease of use, navigation, text readability, media accessibility, and operational convenience. The instructional design expert evaluated visual appearance, layout, color combinations, font size, image quality, and the overall attractiveness of the design.

In addition to expert validation, the digital pocketbook was evaluated by all 30 seventh-grade students at SMP Negeri 2 Lakea. Total sampling was applied because all students in the class were included as research respondents. The student evaluation was conducted to assess the attractiveness of the medium, ease of use, ease of understanding the material, and its perceived usefulness in supporting the learning process.

Data analysis was conducted systematically through several interrelated stages beginning with field data collection. The plant inventory data were analyzed descriptively by grouping the identified plants according to family, growth form, and taxonomic classification. The identification results were presented in tables and scientific descriptions.

The expert-validation and student-response data were analyzed using a feasibility percentage, calculated with the following formula:

$$\text{Feasibility percentage} = \frac{\text{Maximum possible score}}{\text{Total score obtained}} x100\%$$

The resulting percentages were interpreted according to the feasibility criteria proposed by Arikunto & Jabar (2018), as presented in Table 1.

Table 1. Feasibility criteria for the learning media

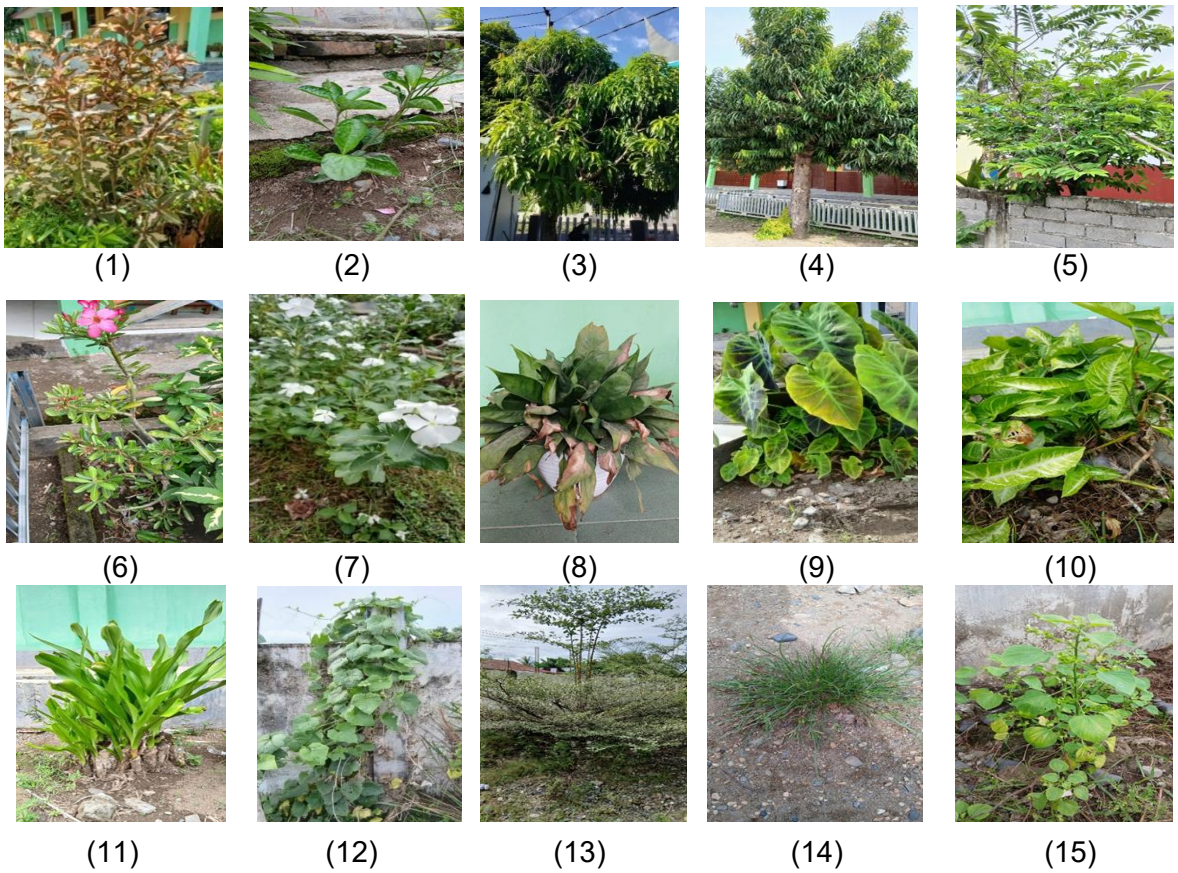
Percentage	Feasibility Category
81–100%	Highly feasible
61–80%	Feasible
41–60%	Moderately feasible
21–40%	Less feasible
0–20%	Not feasible

RESULTS AND DISCUSSION

Plant identification conducted throughout the grounds of SMP Negeri 2 Lakea recorded 35 species belonging to 20 families. The identified plants represented four growth forms: herbs (18 species), shrubs (2 species), woody shrubs (8 species), and trees (7 species). Visual documentation of each species is presented in Figure 2, while their taxonomic classification, local names, and growth forms are provided in Table 2.

The occurrence of several vegetation layers and plant-use categories indicates that the school grounds function not only as landscaped space but also as a small-scale habitat. Vegetated school grounds may support ecological functions, provide aesthetically appealing environments, increase students' contact with plants, and

supply biological materials that can be incorporated into teaching activities (Katsoulas et al., 2016).



Note: (1) *Graptophyllum pictum* L., (2) *Ruellia tuberosa* L., (3) *Mangifera indica* L., (4) *Monoon longifolium* (Sonn.) B. Xue & R. M. K. Saunders, (5) *Annona squamosa* L., (6) *Adenium obesum* (Forssk.) Roem. & Schult., (7) *Catharanthus roseus* L., (8) *Spathiphyllum blandum* Schott, (9) *Colocasia esculenta* L., (10) *Syngonium podophyllum* Schott, (11) *Crinum asiaticum* L., (12) *Sechium edule* Jacq., (13) *Terminalia mentaly* H. Perrier, (14) *Cyperus compressus* L., (15) *Acalypha indica* L., (16) *Manihot esculenta* Crantz, (17) *Euphorbia hirta* L., (18) *Codiaeum variegatum* L., (19) *Euphorbia milii*, (20) *Euphorbia tithymaloides* L., (21) *Arachis hypogaea* L., (22) *Grona triflora* L., (23) *Leucas lavandulifolia*, (24) *Muntingia calabura* L., (25) *Syzygium oleina* L., (26) *Syzygium samarangense* (Blume) Merr. & L. M. Perry, (27) *Boerhavia diffusa* L., (28) *Phyllanthus amarus* L., (29) *Cymbopogon citratus* (DC.) Stapf, (30) *Agrostis capillaris* L., (31) *Portulaca oleracea* L., (32) *Ixora coccinea* L., (33) *Morinda citrifolia* L., (34) *Spermacoce verticillata* L., and (35) *Elettaria cardamomum* L.

Figure 2. Plant species recorded on the grounds of SMP Negeri 2 Lakea

Table 2. Plant species recorded on the grounds of SMP Negeri 2 Lakea

No	Family	Species	Common name	Growth form
1	Acanthaceae	*Graptophyllum pictum* L.	Daun ungu	Woody shrub
2	Acanthaceae	*Ruellia tuberosa* L.	Kencana ungu liar	Herb
3	Anacardiaceae	*Mangifera indica* L.	Mangga	Tree
4	Annonaceae	*Monoon longifolium* (Sonn.) B. Xue & R. M. K. Saunders	Glodokan tiang	Tree
5	Annonaceae	*Annona squamosa* L.	Srikaya	Tree
6	Apocynaceae	*Adenium obesum* (Forssk.) Roem. & Schult.	Kamboja Jepang	Woody shrub
7	Apocynaceae	*Catharanthus roseus* L.	Tapak dara	Woody shrub
8	Araceae	*Spathiphyllum blandum* Schott	Lili perdamaian	Herb

No	Family	Species	Common name	Growth form
9	Araceae	*Colocasia esculenta* L.	Talas	Herb
10	Araceae	*Syngonium podophyllum* Schott	Keladi rambat	Herb
11	Amaryllidaceae	*Crinum asiaticum* L.	Bakong	Herb
12	Cucurbitaceae	*Sechium edule* Jacq.	Labu Siam	Herb
13	Combretaceae	*Terminalia mentaly* H. Perrier	Ketapang kencana varigata	Tree
14	Cyperaceae	*Cyperus compressus* L.	Lulangan	Herb
15	Euphorbiaceae	*Acalypha indica* L.	Kucing galak	Herb
16	Euphorbiaceae	*Manihot esculenta* Crantz	Ubi kayu	Woody shrub
17	Euphorbiaceae	*Euphorbia hirta* L.	Patikan kebo	Herb
18	Euphorbiaceae	*Codiaeum variegatum* L.	Puring	Woody shrub
19	Euphorbiaceae	*Euphorbia milii*	Mahkota duri	Woody shrub
20	Euphorbiaceae	*Euphorbia tithymaloides* L.	Patah tulang	Shrub
21	Fabaceae	*Arachis hypogaea* L.	Kacang tanah	Herb
22	Fabaceae	*Grona triflora* L.	Semanggi	Herb
23	Lamiaceae	*Leucas lavandulifolia*	Ketumpang air	Herb
24	Muntingiaceae	*Muntingia calabura* L.	Kersen	Tree
25	Myrtaceae	*Syzygium oleina* L.	Pucuk merah	Woody shrub
26	Myrtaceae	*Syzygium samarangense* (Blume) Merr. & L. M. Perry	Jambu air	Tree
27	Nyctaginaceae	*Boerhavia diffusa* L.	Daun cakaran	Shrub
28	Phyllantaceae	*Phyllanthus amarus* L.	Meniran	Herb
29	Poaceae	*Cymbopogon citratus* (DC.) Stapf	Serai	Herb
30	Poaceae	*Agrostis capillaris* L.	Rumput minyak	Herb
31	Portulacaceae	*Portulaca oleracea* L.	Krokot	Herb
32	Rubiaceae	*Ixora coccinea* L.	Bunga Asoka	Woody shrub
33	Rubiaceae	*Morinda citrifolia* L.	Mengkudu	Tree
34	Rubiaceae	*Spermacoce verticillata* L.	Lidah ular	Herb
35	Zingiberaceae	*Elettaria cardamomum* L.	Kapulaga seberang	Herb

As shown in Figure 2 and Table 2, the recorded vegetation included ornamental, shade, medicinal, food, spice, and wild plants with diverse morphological characteristics. These plants were classified into four growth forms: herbs, woody shrubs, shrubs, and trees.

1. Herbaceous plants

Herbs were the most dominant growth form on the grounds of SMP Negeri 2 Lakea, comprising 18 species, of which eight were cultivated and ten grew naturally. This predominance may be associated with the environmental characteristics of the school grounds, which largely consist of open areas receiving high solar radiation and providing extensive space for plant establishment. Periodic disturbances caused by maintenance, mowing, trampling, and land-clearing activities may also favor herbaceous plants.

These conditions are particularly suitable for herbs, which generally have relatively short life cycles, rapid reproductive rates, and a high capacity to adapt to environmental disturbance. Consequently, they can readily establish and spread across different sections of the school grounds (Sulasmini, 2019). The dominance of herbaceous species is consistent with the ecological characteristics of frequently disturbed open habitats, where plants with rapid growth and efficient reproduction are

generally favored (Rao & Chauhan, 2020). Nevertheless, the presence of spontaneous herbaceous vegetation should not be interpreted solely as an indicator of environmental degradation. Wild plants can contribute to vegetation diversity and provide opportunities for students to observe plant adaptation, competition, succession, and interactions between organisms and their environment.

Common cultivated herbs included *Spathiphyllum blandum* Schott, *Colocasia esculenta* L., *Syngonium podophyllum* Schott, and *Crinum asiaticum* L., which were primarily planted as ornamentals in front of classrooms. *Cymbopogon citratus* (DC.) Stapf and *Elettaria cardamomum* L. were also cultivated because of their economic value as spice and medicinal plants.

Among the wild herbaceous species, *Euphorbia hirta* L., *Cyperus compressus* L., *Grona triflora* L., and *Agrostis capillaris* L. were prevalent in open areas and on the school field. Their occurrence may be associated with their ability to grow in disturbed or degraded soils under high light intensity (Rao & Chauhan, 2020).

Several herbaceous species also have medicinal value. *Catharanthus roseus* L. contains alkaloid compounds that have been used in pharmaceutical applications (Budiman et al., 2019), whereas *Phyllanthus amarus* L. has been reported to possess immunomodulatory potential (Fauziyah & Mahendra, 2024). The diversity of herbaceous species makes this group particularly relevant for contextual learning activities concerning monocotyledonous and dicotyledonous morphology, plant adaptation, and species-level biodiversity.

2. Woody shrubs

The woody shrubs recorded on the grounds of SMP Negeri 2 Lakea were *Graptophyllum pictum* L., *Ixora coccinea* L., *Adenium obesum*, *Manihot esculenta*, *Codiaeum variegatum* L., *Euphorbia milii*, *Catharanthus roseus* L., and *Syzygium oleina*. Woody shrubs generally have lignified stems, extensive branching, and a shorter stature than trees.

Most of these species were deliberately cultivated as ornamental plants because of their attractive flowers, foliage, or stem forms. *Manihot esculenta* was cultivated as a food crop, whereas *Catharanthus roseus* was also valued for its medicinal properties. These findings are consistent with Arifin & Wahyudi (2020), who reported that woody shrubs are widely used as ornamental plants because of their aesthetic value. Wulandari & Nuraini (2024) similarly explained that *Adenium obesum* has economic value and adapts well to tropical environmental conditions.

The presence of woody shrubs therefore contributes not only to the visual quality of the school landscape but also to the availability of authentic materials for learning about plant diversity, morphology, and use. School vegetation can provide both functional and aesthetically appealing environments while increasing direct contact between students and plants (Katsoulas et al., 2016).

Graptophyllum pictum L. was particularly abundant at SMP Negeri 2 Lakea. Its abundance may be associated with its attractive purple foliage, ease of cultivation, low maintenance requirements, and capacity for rapid propagation. These characteristics make the species suitable for school grounds where plant maintenance may be limited. It is also commonly planted as a living fence because its dense foliage creates a more orderly and visually appealing environment.

3. Shrubs

Two shrub species were identified on the school grounds: *Euphorbia tithymaloides* L. and *Boerhavia diffusa* L. Their occurrence reflects their ability to

persist under tropical environmental conditions and contributes to the overall vegetation diversity of the school.

In addition to functioning as components of the vegetation that structures the local ecosystem, several plants associated with the herb–shrub layer have potential medicinal value. Handayani et al. (2020) reported that *Ruellia tuberosa* contains bioactive compounds with potential antibacterial and antioxidant activities. *Boerhavia diffusa* contains alkaloids, flavonoids, and phenolic compounds and has been used in traditional medicine (Kementerian Kesehatan RI, 2021). Kaur et al. (2021) also described *Acalypha indica* as an herbaceous-shrubby plant containing secondary metabolites that has long been used in traditional medicine.

These species can therefore serve as relevant examples when teaching the relationships among plant morphology, adaptation, secondary metabolites, and traditional plant use. However, information regarding medicinal properties should be presented as ethnobotanical and scientific knowledge rather than as a recommendation for unsupervised therapeutic use.

4. Trees

The tree species identified on the grounds of SMP Negeri 2 Lakea were *Mangifera indica* L., *Monoon longifolium*, *Annona squamosa* L., *Morinda citrifolia* L., *Muntingia calabura* L., *Syzygium samarangense*, and *Terminalia mantaly*. These species are characterized by strong woody stems, relatively large stature, and long life spans.

Trees play important ecological roles in the school environment by providing shade, moderating local environmental conditions, and creating habitats for other organisms. Trees and other woody vegetation also increase the structural complexity of school grounds and may provide food, shelter, perching sites, and nesting opportunities for various organisms. Green school environments that contain diverse biotic elements can support local biodiversity and provide meaningful opportunities for interaction with nature (van den Bogerd et al., 2025).

Several species, including *Mangifera indica*, *Annona squamosa*, *Morinda citrifolia*, *Muntingia calabura*, and *Syzygium samarangense*, produce fruits that can be used as food. In contrast, *Monoon longifolium* and *Terminalia mantaly* are commonly planted for greening and landscape ornamentation. These findings are consistent with Ramadhan et al. (2024), who described *Mangifera indica* as a perennial fruit tree that also functions as a shade plant. Orwa et al. (2021) similarly explained that *Monoon longifolium* is frequently used in landscaping because of its attractive crown architecture.

Seven tree species were recorded, including five cultivated and two naturally occurring species. Most cultivated trees were planted in the front yard, particularly near the parking area, where they functioned as shade trees. Other trees were planted in front of classrooms to create cooler and more comfortable surroundings. Therefore, the trees at SMP Negeri 2 Lakea have ecological, economic, aesthetic, and educational value as resources for learning about plant diversity.

Family-Level Composition and Plant Distribution

Euphorbiaceae was the most species-rich family, represented by five species: *Acalypha indica* L., *Manihot esculenta* Crantz, *Euphorbia hirta* L., *Codiaeum variegatum* L., and *Euphorbia milii*. The relatively high number of Euphorbiaceae species may indicate that members of this family are well adapted to the open and tropical conditions of the school environment.

Many members of Euphorbiaceae also have economic, ornamental, or medicinal value. Consequently, some species were deliberately cultivated, whereas others grew naturally on the school grounds. Their contrasting morphologies and uses make them suitable examples for introducing family-level similarities and differences in plant-classification activities.

The recorded plants were distributed from the school entrance and areas in front of classrooms to the rear section of the school. Herbaceous plants were particularly common in the rear and other relatively open areas. All eight woody-shrub species were cultivated, predominantly as ornamentals intended to improve the visual quality of the entrance and classroom surroundings. Trees were primarily planted as shade vegetation, while shrubs were the least abundant growth form, with only one cultivated and one wild species recorded.

Overall, the plant community consisted of four main growth forms: herbs, shrubs, woody shrubs, and trees. Differences among these forms reflect variation in plant morphology, anatomy, physiology, genetics, and ecological adaptation. This interpretation is consistent with Sulasmini (2019), who stated that natural variation in plants can be expressed through morphological, anatomical, physiological, genetic, and ecosystem-level characteristics.

Comparison with Previous Plant Inventories

The 35 species from 20 families recorded at SMP Negeri 2 Lakea were fewer than the 91 species from 38 families reported by Juheti (2018) on the Tadulako University campus and the 54 species identified by Tira Elovani (2022) at SMA Negeri 1 Sindue.

These differences may be explained by three principal factors. First, the Tadulako University campus covers a substantially larger area than SMP Negeri 2 Lakea, which occupies approximately 4,950 m². Second, a university campus may contain a greater range of habitats and vegetation types. Third, differences in landscape design, planting practices, maintenance intensity, and human disturbance may influence the number of species that can establish and persist.

Species richness should therefore not be interpreted independently of site area, habitat heterogeneity, vegetation structure, and management practices. A relatively small school may contain fewer plant species than a university campus while still providing substantial ecological and educational functions. School grounds can serve as important green spaces by increasing students' contact with plants and providing biological material for teaching, even when their vegetation area is limited (Katsoulas et al., 2016).

The School Grounds as a Contextual Learning Resource

The diversity of plant growth forms, morphological characteristics, and uses indicates that SMP Negeri 2 Lakea has considerable potential to function as a natural laboratory for biology education. Students can directly observe authentic specimens when learning about plant classification, morphology, adaptation, medicinal plants, ecosystem components, and biodiversity.

Environment-based learning can help students connect theoretical concepts with observable conditions in their immediate surroundings. Green school grounds are particularly valuable because they provide students with repeated and accessible contact with living organisms. They can support direct observation, inquiry, comparison, classification, practical investigation, educational games, and collaborative learning.

Katsoulas et al. (2016) reported that both students and teachers supported the presence of vegetation on school grounds and responded positively to using plant materials in educational activities. The authors emphasized that school vegetation could provide functional and aesthetically pleasing environments while increasing child–plant contact.

Similarly, van den Bogerd et al. (2025) found that green schoolyards were used for various educational subjects and teaching methods, including inquiry-based learning, educational games, practical activities, and skill reinforcement. However, their observations also showed that natural elements were not always used optimally in instructional activities. These findings support the development of structured teaching resources that can assist teachers in integrating school vegetation into regular instruction.

A digital pocketbook containing photographs, scientific names, morphological descriptions, plant uses, and observation locations can provide such instructional guidance. Before outdoor activities, students can use the flipbook to become familiar with the species and their diagnostic characteristics. During field observations, they can compare actual specimens with the photographs and descriptions provided. After observation, the medium can support discussion, classification, and consolidation of learning.

Feasibility of the Digital Learning Medium

The feasibility of the developed digital pocketbook was assessed through expert validation and student evaluation. The results are presented in Table 3.

Table 3. Validation results for the developed learning medium

Evaluator	Percentage (%)	Category
Content expert	80	Feasible
Media expert	83	Highly feasible
Design expert	87	Highly feasible
Students	91	Highly feasible
Mean	**85**	**Highly feasible**

The overall mean score of 85% placed the developed medium in the highly feasible category. The media and design experts awarded scores of 83% and 87%, respectively, indicating positive assessments of usability, navigation, visual presentation, readability, and layout. Students provided the highest score, at 91%, suggesting that they perceived the medium as attractive, accessible, and easy to use.

The positive student responses were particularly associated with visual attractiveness, simple navigation, concise presentation, relevant photographs, and accessible language. Students also considered the flipbook interactive and easier to engage with than materials presented only through conventional text. These results are consistent with Fitriani et al. (2022), who stated that learning media designed according to students' characteristics can enhance attention, motivation, and comprehension.

The findings are also supported by Herianto et al. (2022), who conducted a quasi-experimental study involving 64 lower-secondary students and found that students who used interactive multimedia e-books demonstrated significantly greater curiosity in science than those who used printed textbooks. The study indicates that combining

text, images, and interactive multimedia features can encourage students to explore scientific information more actively.

The content component received the lowest validation score, at 80%, although it remained within the feasible category. This score reflected several aspects requiring further improvement, particularly content completeness, consistency in writing scientific names, and the presentation of information on plant uses. In response to the validators' recommendations, the scientific nomenclature was revised, descriptions of plant uses were expanded, and the language was refined before the medium was used in learning activities.

Nevertheless, these validation results primarily demonstrate perceived feasibility, quality, and usability. They should not be interpreted as direct evidence that the flipbook improves students' academic achievement. The present study did not employ a pre-test–post-test design, a comparison group, or an objective assessment of learning gains. Therefore, statements concerning improved understanding should remain limited to students' reported perceptions until the medium is evaluated through an experimental or quasi-experimental design.

Educational Potential of the Digital Pocketbook

The developed digital pocketbook functions as more than a means of presenting information. It has the potential to support students' understanding of plant diversity because it organizes information concisely, systematically, and contextually (Fitriani et al., 2022). The learning material is based on plants that students can observe in their immediate environment, making the content more relevant and accessible.

Digital pocketbooks offer practical advantages because they can be accessed through portable devices. The flipbook format may additionally support interactivity and student engagement during learning (Elpina et al., 2022). However, digital features are most educationally valuable when they guide meaningful cognitive activities rather than merely replacing printed pages.

Sung et al. (2019) found that an interactive e-book incorporating a problem-posing strategy significantly improved students' learning achievement, critical-thinking tendency, and deep learning motivation in a natural science course. Their findings demonstrate that interactive e-books can provide stronger instructional support when students are guided to observe, formulate questions, and actively process scientific information.

Accordingly, future versions of the SMP Negeri 2 Lakea flipbook could include observation questions, species-comparison tasks, identification exercises, and short reflective activities. These features could direct students' attention to relevant morphological characteristics and encourage inquiry rather than passive reading. The use of photographs taken directly on the school grounds strengthens the contextual value of the medium. The flipbook can bridge digital learning and direct environmental observation by helping students recognize plants before fieldwork, identify them during exploration, and review their characteristics after completing the activity.

Thus, this study produced not only scientific data on the plant species found at SMP Negeri 2 Lakea but also a practical, locally grounded learning resource aligned with developments in educational technology. The medium may help teachers use existing school vegetation more systematically and support learning that is more relevant to students' everyday environment.

Limitations and Implications for Further Research

Despite its advantages, the developed flipbook has several limitations. Its use requires digital devices such as smartphones, tablets, or computers, as well as reliable

access to electricity and adequate digital literacy. Its visual quality is also strongly influenced by the quality of the plant photographs and the screen size of the device used by students (Nuraini & Putra, 2022).

The plant inventory was conducted during the dry season and was based on three field surveys. Seasonal differences in flowering, fruiting, germination, and the occurrence of annual plants may have affected species detectability. Therefore, the 35 recorded species should be interpreted as the species observed during the study period rather than as a definitive inventory of every plant occurring throughout the year. Future studies should conduct repeated surveys during both wet and dry seasons.

Future taxonomic work should also verify accepted scientific names and author citations using updated taxonomic databases, identification keys, or herbarium specimens. This verification is particularly important for species whose nomenclature, family placement, or growth-form classification may vary among references.

In addition, the study assessed the flipbook through expert validation and student responses but did not evaluate learning achievement, knowledge retention, long-term use, or changes in environmental attitudes. Further research should test the medium through classroom- and field-based implementation using pre-tests and post-tests, comparison groups, and delayed assessments. These approaches would provide stronger evidence regarding its effectiveness in improving plant-identification skills, conceptual understanding, learning motivation, and knowledge retention.

Overall, the results demonstrate that the grounds of SMP Negeri 2 Lakea contain diverse plant resources that can support contextual biology education. Integrating the inventory into a digital pocketbook provides a practical means of linking scientific information with direct observation. However, continued taxonomic verification, seasonal inventory, instructional refinement, and effectiveness testing are required to strengthen the scientific and educational contributions of the developed medium.

CONCLUSION

The study identified 35 plant species belonging to 20 families within the grounds of SMP Negeri 2 Lakea. The recorded plants represented four growth forms: herbs, shrubs, bushes, and trees, with herbs constituting the dominant group. This plant diversity demonstrates that the school environment has considerable potential as a contextual learning resource for biology education, particularly for topics related to biodiversity and plant classification. The inventory results were subsequently developed into a locally based digital pocketbook in flipbook format. Based on evaluations by content, media, and design experts, as well as student responses, the developed medium achieved an average feasibility score of 85% and was classified as highly feasible. Therefore, the flipbook has the potential to support biology learning that is more engaging, contextual, and accessible to students.

RECOMMENDATION

Future studies should expand the range of plant species investigated and develop more interactive learning media by incorporating current digital technologies. The findings of this study may also serve as scientific data and a learning resource for teachers and students, particularly at SMP Negeri 2 Lakea. In addition, the plant inventory may provide a useful reference for community members and university students conducting practical activities or research on the morphology of plant species found in school environments.

ACKNOWLEDGMENT

The authors sincerely thank the research supervisors, academic advisor, research team, parents, family members, and all parties who provided facilities, guidance, encouragement, and other forms of support. The authors also gratefully acknowledge everyone who contributed to the implementation of the study entitled "Plant Species in the Grounds of SMP Negeri 2 Lakea, Buol Regency, and Their Use as Learning Media."

REFERENCES

Akoumianaki-Ioannidou, A., Paraskevopoulou, A. T., & Tachou, V. (2016). School grounds as a resource of green space to increase child–plant contact. *Urban Forestry & Urban Greening, 20*, 375–386. https://doi.org/10.1016/j.ufug.2016.10.009

Arifin, Z., & Wahyuni, S. (2020). Pemanfaatan tanaman hias dalam meningkatkan estetika lingkungan sekolah. *Jurnal Pendidikan Biologi Indonesia, 6*(2), 101–108.

Arikunto, S., & Jabar, C. S. A. (2018). *Evaluasi program pendidikan*. Bumi Aksara.

Budiman, A., & Kurniawati, E. (2019). Analisis kandungan alkaloid pada tanaman tapak dara (*Catharanthus roseus* L.). *Jurnal Kimia Terapan Indonesia, 4*(2), 70–77.

Cunninghame, A. R., & Stanley, M. C. (2024). Vegetation complexity and greenspace diversity in urban schools. *Urban Forestry & Urban Greening, 101*, Article 128544. https://doi.org/10.1016/j.ufug.2024.128544

Elpina, N., Deswati, L., & Sari, R. T. (2022). Pengembangan media pembelajaran biologi berbentuk buku saku dilengkapi peta konsep pada materi Plantae siswa kelas X SMA Kartika 1-5 Padang. *Jurnal Esabi (Edukasi dan Sains Biologi), 4*(1), 1–10.

Fauziyah, S., & Mahendra, Y. (2024). Analisis potensi farmakologi tanaman meniran (*Phyllanthus amarus* L.) sebagai bahan obat alami. *Jurnal Ilmu Farmasi Indonesia, 11*(1), 55–63.

Fitriani, A., Rahmawati, D., & Putra, I. (2022). Pengembangan media pembelajaran berbasis multimedia interaktif untuk meningkatkan hasil belajar siswa. *Jurnal Teknologi Pendidikan Indonesia, 11*(2), 98–107.

Fitriani, D., Anwar, Y., & Hidayat, T. (2022). Pengaruh penggunaan media pembelajaran berbasis flipbook terhadap hasil belajar siswa. *Jurnal Pendidikan Biologi, 14*(2), 85–93.

Handayani, S. N., Purwanti, A., Windasari, W., & Ardian, M. N. (2020). Uji fitokimia dan aktivitas antibakteri ekstrak etanol daun kencana ungu (*Ruellia tuberosa* L.). *Walisongo Journal of Chemistry, 3*(2), 1–7.

Herianto, Wilujeng, I., & Lestari, D. P. (2022). Effect of interactive multimedia e-books on lower-secondary school students' curiosity in a science course. *Education and Information Technologies, 27*(7), 9619–9639.

Juheti. (2018). *Inventarisasi tumbuhan yang ada di kawasan Kampus Universitas Tadulako sebagai media pembelajaran ekologi tumbuhan* [Skripsi tidak dipublikasikan]. Universitas Tadulako.

Juminah, & Panjaitan, R. G. (2021). Kelayakan buku saku materi sistem ekskresi kelas XI SMA. *Jurnal Pendidikan Informatika dan Sains, 10*(2), 123–131.

Kaur, R., Sharma, M., & Kumar, S. (2021). Morphological and phytochemical characteristics of *Acalypha indica* L.: A review. *International Journal of Plant Sciences, 16*(1), 25–32.

Kementerian Kesehatan Republik Indonesia. (2021). *Pemanfaatan tanaman obat tradisional Indonesia*.

Lindemann-Matthies, P., & Köhler, K. (2019). Naturalized versus traditional school grounds: Which elements do students prefer and why? *Urban Forestry & Urban Greening, 46*, Article 126475. https://doi.org/10.1016/j.ufug.2019.126475

Naisila, Kholimah, S. P. N., Chairunnisa, V. O., & Viratama, I. P. (2024). Tumbuhan. *Jurnal Bioedutech: Jurnal Biologi dan Pendidikan Biologi, 3*(2), 193–204.

Nuraini, A., Sari, M., & Putra, I. (2022). Efektivitas media pembelajaran interaktif berbasis digital dalam meningkatkan pemahaman konsep siswa. *Jurnal Inovasi Pendidikan, 9*(3), 120–129.

Orwa, C., Mutua, A., Kindt, R., Jamnadass, R., & Simons, A. (2021). Kajian pemanfaatan tanaman glodokan tiang (*Monoon longifolium*) sebagai tanaman peneduh di kawasan perkotaan. *Jurnal Lanskap Indonesia, 12*(2), 45–52.

Rahayu, S., Widodo, A., & Lestari, N. (2021). Pengaruh media pembelajaran flipbook terhadap hasil belajar siswa pada materi IPA. *Jurnal Pendidikan Sains Indonesia, 9*(3), 210–218.

Ramadhan, F., Ramadana, M. M., Hastin, M. R., & Supriatna, A. (2024). Identifikasi karakter morfologi mangga (*Mangifera indica* L.) di Kecamatan Panyileukan, Jawa Barat, Indonesia. *Jurnal Botani, 4*(1), 1–10.

Rao, A. N., & Chauhan, B. S. (2020). Weeds and weed management in rice ecosystems. *Agronomy Journal, 112*(3), 1–15.

Silalahi, M. (2020). Keanekaragaman tumbuhan pekarangan dan pemanfaatannya untuk prasarana pembelajaran di Sekolah PSKD 1 Jakarta sebagai salah satu usaha konservasi. *Jurnal EduMatSains, 3*(1), 1–20.

Sulasmini. (2019). Keanekaragaman tumbuhan berdasarkan karakter morfologi, anatomi, fisiologi, genetik, dan ekosistem. *Jurnal Biologi dan Pembelajaran Biologi, 4*(2), 85–92.

Sung, H.-Y., Hwang, G.-J., & Chen, S.-F. (2019). Effects of embedding a problem-posing-based learning guiding strategy into interactive e-books on students' learning performance and higher-order thinking tendency. *Interactive Learning Environments, 27*(3), 389–401. https://doi.org/10.1080/10494820.2018.1474235

Supriatna. (2018). Klasifikasi tumbuhan berpembuluh. *Jurnal Biologi, 6*(9), 11–23.

Tira Elovani, B. R. G. (2022). *Jenis-jenis tumbuhan di area SMA Negeri 1 Sindue dan pemanfaatannya sebagai media pembelajaran biologi* [Skripsi tidak dipublikasikan]. Universitas Tadulako.

Tjitrosoepomo, G. (2017). *Taksonomi tumbuhan (Spermatophyta)*. Gadjah Mada University Press.

Unayah, H., Rasyid, M., Suyanta, S., Wilujeng, I., & Rahmawati, L. (2024). A recent study on flipbook as media implementation in science education in the digital age: A systematic literature review. *Unnes Science Education Journal, 13*(3). https://doi.org/10.15294/usej.v13i3.17200

van den Bogerd, N., Peters, E., Hovinga, D., & Maas, J. (2025). The use of green schoolyards for education: Results of teacher surveys and observations. *Journal of Outdoor and Environmental Education*. Advance online publication. https://doi.org/10.1007/s42322-025-00220-9

Wahyudi, R. P. (2020). *Jenis-jenis tumbuhan di pekarangan SMP Negeri 11 Sungai Penuh* [Skripsi, Universitas Sumatera Utara].

Wahyuni, D., & Lestari, S. (2023). Pengembangan media pembelajaran berbasis flipbook untuk meningkatkan kemandirian belajar siswa. *Jurnal Pendidikan dan Pembelajaran, 12*(2), 99–110.

Wulandari, F., & Nuraini, L. (2024). Karakteristik morfologi dan pemanfaatan tanaman hias kamboja Jepang (*Adenium obesum*) di daerah tropis. *Jurnal Agroteknologi Indonesia, 9*(1), 45–52.

Yemini, M., Engel, L., & Ben Simon, A. (2025). Place-based education: A systematic review of literature. *Educational Review, 77*, 640–660. https://doi.org/10.1080/00131911.2023.2177260