



Development of plants morphology characteristics textbook to improve students' ability in identifying plants



Angreni Beaktris Liunokas ^{*}, Agsen Hosanty Susana Billik²

¹Primary School Teacher Education Study Program, STKIP Soe, Indonesia

²Biology Education Study Program, STKIP Soe, Indonesia

*Corresponding author: liunokasrenni@gmail.com

Article Info

Article History:

Received 05 October 2021

Revised 12 November 2021

Accepted 01 March 2022

Published 30 April 2022

Keywords:

Morphology

Textbooks

Identification

Characteristics



ABSTRACT

The selection and use of appropriate textbooks in the lecture process is an important factor for improving science process skills. This study aims to develop textbooks on plant morphological characteristics that are valid, practical, and effective in increasing students' ability to identify plants. The method used is research and development with a design Plomp model which consists of five stages in the form of (1) initial investigation, (2) design, (3) realization, (4) testing, evaluation, and revision, (implementation). The subjects of this study were students who took plant anatomy and morphology courses, the academic year 2020/2021 of the STKIP Soe Biology education study program. Data collection techniques in the form of observation, tests, and questionnaires. The product in the form of a textbook developed was tested for validity based on the research results of the expert team as a validator. The practicality of the product was tested using a student and lecturer response questionnaire analysis. The textbook effectiveness test was carried out through quasi-experimental research with analytical techniques using an independent sample T-test and normalized gain scores. The results showed that the textbooks developed were valid, practical, and effective to improve students' ability to identify plant species.

Copyright © 2022, Liunokas & Billik

This is an open access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license



Citation: Liunokas, A. B., & Billik, A. H. S. (2022). Development of plants morphology characteristics textbook to improve students' ability in identifying plants. *JPBIO (Jurnal Pendidikan Biologi)*, 7(1), 11-19. DOI: <https://doi.org/10.31932/jpbio.v7i1.I391>

INTRODUCTION

Biology is a science that provides a variety of learning experiences to understand the concepts and processes of science. Biological science is a study of science that in its implementation is always

closely related to life processes with the interaction of the natural surroundings consisting of processes and products (Airlanda & Suciati., 2011; Sumaryani & Parmithi, 2021). One of the branches of biology is morphology from the Latin *Morpheus* which means form or shape (Sarjani, et al., 2017). Morphology is the study of the shape, the structure of the body, the external appearance of the body, various organs, and their accessories (Susilawati, et al., 2018; Utomo, et al., 2018).

The morphological form is a very large indicator for visually identifying plants, so a very diverse plant diversity can be found and classified to facilitate the naming of species, families, and kingdoms (Susilawati, et al., 2018). The morphology of a plant species is a feature that is easy to observe (Hadiyanti, et al., 2018). Morphology consists of two, namely external morphology and internal morphology called anatomy. The morphological characteristics of plants can be observed from the main organs of plants which include roots, stems, leaves, flowers, and fruits. These five plant parts can provide a fairly in-depth study to study the overall structure of the plant body, because the study of plant morphology is basic in studying certain plant groups, as a basis in plant taxonomy and botany.

Science process skills are currently an important part of knowing the abilities of biology education students, especially in learning anatomy and plant morphology courses that require cognitive skills, manuals, and concrete examples so that students can find, develop their own facts and related concepts and develop attitudes and behavior. The value required in the course in question is the ability to identify plant species (Liunokas, 2020).

Based on the results of observations made to students of the STKIP Soe biology education study program who took anatomy and plant morphology courses in the even semesters of the 2018/2019 and 2019/2020 academic years, it was found that in the learning process students had difficulty recognizing various types of plants around the campus area, and which are used massively by the wider community. Students only know some of the most common types of plants that are used as food ingredients but do not know carefully and deeply about these plants. This causes student learning outcomes on the competence to identify plants in the anatomy and morphology subjects of low plants.

The results of interviews with students found that one of the main causes of the lack of mastery of material on plant morphological characteristics in the anatomy and plant morphology course is the lack of reading material on morphological characteristics in preparing for lectures, where there are no books as practical learning materials for lectures as a guide for students in lectures and as an adequate learning resource to be able to produce quality and productive human resources. (Depdiknas, 2008; Dikti, 2009; Mudlofir, 2011; Artha, et al., 2016). The teaching materials used are only in the form of a plant morphology master book whose contents are still very general, not including teaching materials for certain plants, as well as non-printed PowerPoint files. Students also have difficulty understanding the terms used in identifying plant morphological characteristics, due to limited references, so practical and effective learning resources are needed in improving students' ability to determine plants not only in plant anatomy and morphology courses but also in plant taxonomy. So that students can improve their ability to identify plants, it is necessary to arrange and develop textbooks that can direct and improve students' scientific process skills by maximizing their ability to determine plant species. The selection and use of the right textbooks in the lecture process is a very important factor to improve students' ability to identify plant species in the surrounding environment.

Until now there has been no research conducted related to the conditions that occur in anatomy and morphology lectures, so this is the basis for research on the development of textbooks on plant morphology characteristics to improve students' ability to identify plant species. This

study aims to test the validity, practicality, and effectiveness of textbooks on plant morphology characteristics to improve students' ability to identify plant species.

RESEARCH METHODS

Research Design

Research and development design in designing textbooks on plant morphology characteristics follows the development proposed by Plomp which consists of five stages, namely (1) preliminary investigation stage; (2) the design stage (design); (3) the realization/construction stage (realization/construction); (4) the stages of testing, evaluation, and revision (test, evaluation, revision); and (5) the implementation phase. This research only reached the stages of testing, evaluation, and revision because the implementation stage requires a long process and time. The subjects used in this study were students of the biology education study program STKIP Soe who took the anatomy and morphology of plants which consisted of 23 experimental classes and 19 control classes which were determined using a simple random sampling technique.

Population and Samples

The research was carried out at STKIP Soe, Karang Sirih Village, Soe City District, South Central Timor Regency in the even semester of the 2020/2021 Academic Year. The samples used in this study were students of the biology education study program STKIP Soe who took the anatomy and morphology of plants which consisted of 23 experimental classes and 19 control classes which were determined using a simple random sampling technique.

Instruments

The instruments and data collection techniques used were: (1) observation, used to determine the learning process of plant anatomy and morphology courses on morphological characteristics; (2) tests, used to collect data on students' ability to identify plant species; (3) a questionnaire, used to measure the practicality of the textbooks developed in this study were tested for validity by two validators by taking the average. The practicality of the developed textbooks was tested using student and peer response questionnaires (lecturers). The analytical technique for testing the effectiveness of textbooks uses an independent t-sample test and the calculation of the normalized gain score to determine the categories of increasing students' ability to identify plant species in the experimental class. The data were analyzed using an independent t-sample test to test the effectiveness of textbooks and the calculation of the normalized gain score to determine the category of increasing students' ability to identify plants in the experimental class.

Procedures

The research procedure consists of the preparation stage, the implementation stage, and the data analysis stage. The preparatory stage includes observation, used to determine the learning process of plant anatomy and morphology courses, conducting initial tests, used to collect data on students' abilities in identifying plant species, and making research questionnaires, which are used to measure the practicality of the textbooks developed in the form of student responses and colleagues (lecturers). The final stage of the research includes validity testing, which is used for textbooks developed in the study and tested by two validators by taking the average.

Data Analysis

The product in the form of a textbook of plant morphological characteristics that was developed was tested for validity based on the results of research from a team of experts as validators. The practicality of the product was tested using a questionnaire analysis of student and lecturer responses. The test of the effectiveness of textbooks to improve students' ability to identify

plants was carried out through quasi-experimental research with analytical techniques using independent sample t-tests and normalized gain scores.

RESULT

Research and development design in designing textbooks on plant morphology characteristics follows the development proposed by Plomp which consists of five stages, namely (1) preliminary investigation stage; (2) the design stage (design); (3) the realization/construction stage (realization/construction); (4) the stages of testing, evaluation, and revision (test, evaluation, revision); and (5) the implementation phase. This research only reached the stages of testing, evaluation, and revision because the implementation stage requires a long process and time.

The product in the form of a book of plant morphological characteristics that was developed was tested for validity based on the results of research from a team of experts as validators. The validation of the textbooks was carried out by a team of experts consisting of 2 lecturers who are experienced in teaching plant anatomy and morphology, especially plant morphology, and conducting related research. The comments obtained are that there are some errors in typing and placing images that are still wrong and some use of terms that are not consistent. All comments have been used in the revision of the textbook. The results of the validation of textbooks by two validators are as shown in Table I.

Table I. Textbook validation results

No	Validator	Evaluation Percentage (%)
1	Validator 1	84.62
2	Validator 2	92.31
	Average	88.46

The validation results in table I show that the developed textbook is valid in the very valid category because it is in the range of $86\% \leq P_v \leq 100\%$ so that the book is feasible to use. Textbooks of plant morphological characteristics that have been declared valid are then tested to see their practicality and effectiveness. The trial followed a quasi-experimental model designed in the form of a nonequivalent control group design. The trial involved two sample classes, namely the experimental class (taught using a textbook on plant morphology characteristics) and the control class (not taught using the book). The results of the student's mathematical representation ability test are presented in Table 2.

Table 2. Student ability test results in identifying plants

Statistik	Control Class (n=11)		Experiment Class (n=23)	
	Pre-test	Post-test	Pre-test	Post-test
The highest score	60	65	69	90
Lowest Value	40	50	50	65
Average	52.36	56.64	57.13	75.78
Standard Intersection	6.50	5.04	4.30	6.21

The practicality test of the developed textbooks was carried out through a questionnaire of 23 student responses and two lecturer responses. The results of the questionnaire analysis are summarized in Table 3.

Table I. Results of questionnaire responses to textbooks

No	Validator	Evaluation Percentage (%)
1	Student	87.13
2	Lecturer	82.35
	Average	84.74

DISCUSSION

Research and development design in designing textbooks on plant morphology characteristics follows the development proposed by Plomp which consists of five stages, namely (1) preliminary investigation stage; (2) the design stage (design); (3) the realization/construction stage (realization/construction); (4) the stages of testing, evaluation, and revision (test, evaluation, revision); and (5) the implementation phase (Puspita, 2014; Arianatasari, 2018; Daniel & Taneo, 2019). This research only reached the stages of testing, evaluation, and revision because the implementation stage requires a long process and time.

Initial investigation stage (preliminary investigation)

The initial investigation phase was carried out to determine the basic problems needed in the development of textbooks on plant morphology characteristics to improve students' ability to identify plants. In this phase, curriculum analysis, teaching material analysis, and student analysis are carried out. The results of the curriculum analysis show that the curriculum used in the STKIP Soe biology education study program is a curriculum based on the Indonesian National Qualifications Framework (KKNI). The courses that contain material on morphological characteristics are plant anatomy and morphology courses with a weight of 4 credits which must be programmed by students in even semesters (second semester). Two of the seven Learning Outcomes (CP-MK) of plant anatomy and morphology are related to plant morphological characteristics, namely: a) Students can explain the morphological characteristics of plants and b) Students can explain the The two CP-Mk, were then developed into morphological characteristics of roots, stems, leaves, fruits and seeds.

Based on the two CP-MK then developed into seven sub CP-MK, namely: a) Students can explain the meaning of plant morphology, the role and interest of plant morphology with other botanicals; b) Students can explain the characteristics of roots (radix) which consists of understanding roots, root parts, root system and root modification; c) Students can explain about stems (caulis), shape, type, direction of growth, branching, and stem modification; d) Students can explain about leaves (folium), parts, basic shapes or structures, base, edges, ends, bone structure, flesh, surface, color and aroma, compound leaves, complementary tools and leaf modifications; e) Students can explain about flowers (flos), parts, shapes, arrangements, locations, types and formulas of flowers; f) Students can explain about fruit (fructus), fruit parts, and types of fruit; and g) Students can explain about seeds (cemen), seed parts, seed coat, navel, and seed core.

Furthermore, the CP-MK sub is used in the analysis of teaching materials in the morphological characteristic book of plants that will be developed. Teaching materials containing concepts and practice questions are then distributed into seven chapters, namely the introduction of plant morphology characteristics, root morphology, stem morphology, leaf morphology, flower morphology, fruit morphology, and seed morphology. The results of the student analysis also show that the ability of students to identify plants in the STKIP Soe biology education study program for the Academic Years 2018/2019 and 2019/2020, especially in identifying plant species in the environment around campus, has difficulty so that the results are still low. One of the factors is the lack of curiosity, and the available learning resources are only plant morphology parent books which are still very general and have not been devoted to certain plants, besides that, non-printed

learning resources are only PowerPoint files from teaching lecturers that present concepts that do not require skills. Students in analyzing a problem (Rezeqi, *et al.*, 2020). In general, all students have different learning characteristics, the desire to learn is quite good, and students' absorption of the material in learning is quite good.

Design stage (design)

The next stage is the design stage where the results of curriculum analysis, teaching materials, and students are used as the basis for designing textbooks on plant morphology characteristics to improve students' ability to identify plant species. The component of the textbook on plant morphological characteristics is designed to develop the ability to identify, recognize plants specifically and mention known plant species. The components of the plant morphological characteristic textbook consist of the front cover, introduction, table of contents, list of pictures, material per chapter, references, and back cover. In presenting the material for each chapter, starting with the presentation of CP-MK, sub-CP-MK then sub-chapters of material in the form of understanding, morphological characteristics, and practice questions. Each characteristic is accompanied by a picture and an explanation covering all the material in the chapter. According to Nuraida and Umi (2017), biology books that are currently circulating still show old books in a language style that is difficult to understand and often not accompanied by pictures so that the knowledge gained seems boring and the same as other books, so that in the development of this book, it is more complete with pictures.

Realization/construction stage (realization/construction)

This stage is a follow-up to the design stage. Morphological characteristics textbooks are arranged according to the existing design and produce a draft I. To display the morphological characteristics of each plant organ, it is presented clearly and completely, accompanied by pictures to facilitate the development of students' visual abilities in identifying plant species based on vegetative and generative organs, namely roots, stems, leaves, flowers, fruits and seeds. Practice questions in each chapter are also presented to develop students' verbal skills in recognizing well the plants around their environment and being able to describe well what students find using their own words. In conveying the fundamental concepts of plant morphology, the terms used are also consistent in each chapter to avoid ambiguous meaning for students.

Stages of test, evaluation, and revision (test, evaluation, revision)

Draft I of the results of the realization stage was then validated and tested at this stage. The validation of the textbooks was carried out by a team of experts consisting of 2 lecturers who are experienced in teaching plant anatomy and morphology, especially plant morphology, and conducting related research. The comments obtained are that there are some errors in typing and placing images that are still wrong and some use of terms that are not consistent. All comments have been used in the revision of the textbook. The results of the validation of textbooks by two validators are as shown in Table I.

Table 2 shows that the experimental class and control class experienced an increase in students' ability to identify plants with the result that the pre-test score was lower than the post-test score. The average post-test score in the experimental class was greater than the post-test average in the control class, indicating that students' ability to identify plant species was better than the control class.

Further analysis of the effectiveness of textbooks on plant morphological characteristics on increasing students' ability to identify plants was carried out using an independent sample t test. The results of the prerequisite test, namely the normality test, showed that the sample came from a

normally distributed population and the homogeneity test showed that the two research samples came from a homogeneous population. Based on the results of the independent sample t test, $\text{sig} = 0.000 < 0.05$, which means that there is a difference in the ability to identify those taught with textbooks and those who are not, where the average ability to identify plant species taught using textbooks is better than those taught without taught using the textbook. The analysis of the normalized gain score also showed an increase in students' ability to identify experimental class plants in the medium category with an average gain score of 0.55.

These results indicate that the developed plant morphological characteristics textbook can help students to understand the fundamental concepts of plant morphological characteristics and represent them in learning, especially in identifying plant species in the surrounding environment. This is also stated by Mahardika (2011) that textbooks can help students or students in directing all their activities in the learning process as well as a substance of competence that should be studied or mastered. Pangastuti, et al., (2016) stated that the development of the use of textbooks is one way to facilitate the achievement of learning indicators. The same thing was also expressed by Prastowo (2012) where teaching materials as a substance of competence should be taught to students.

The practicality of the developed textbooks is known by giving questionnaires to students and lecturers. Based on thickness 3, the average percentage of responses from students and lecturers is 84.74%, which indicates that textbooks on plant morphology characteristics are practical for use in studying anatomy and plant morphology courses for biology education students at STKIP Soe. This is because learning by using textbooks on plant morphological characteristics encourages students' independent learning to be able to identify the types of plants they encounter and increase students' curiosity.

CONCLUSION

The textbook effectiveness test to improve students' ability to identify plants was carried out through quasi-experimental research with analytical techniques using an independent sample T-test and normalized gain scores. The results showed that the textbooks of plant morphological characteristics developed were valid, practical, and effective to improve students' ability to identify plant species. Based on the results and discussion, it can be concluded that the textbook on plant morphological characteristics is valid and feasible to use in learning as well as practical and effective to improve students' ability to identify plant species in the vicinity.

ACKNOWLEDGMENT

Thank you to the Ministry of Research and Technology/National Research and Technology Agency and Innovation (Kemenristek/Brin) of the Republic of Indonesia for providing research grants for novice lecturers to us.

REFERENCES

- Airlanda, Gamaliel, S., & Sudarisman, S. (2011). Festival sains dalam pembelajaran biologi untuk meningkatkan keterampilan proses sains. *Prosiding Seminar Nasional VIII Pendidikan Biologi FKIP UNS 2011 (Sembio)*. Retrieved from <https://media.neliti.com/media/publications/176339-ID-festival-sains-dalam-pembelajaran-biolog.pdf>
- Arianatasari, A. (2018). Penerapan desain model plomp pada pengembangan buku teks berbasis guided inquiry. *Jurnal Mahasiswa Universitas Negeri Surabaya*. 6(1), 36-40. Retrieved from <https://core.ac.uk/download/pdf/230750051.pdf>
- Artha, Pt Yulyana, G., Saptasari, M., & Mahanal, S. (2016). Pengembangan buku ajar etnobotani melalui studi etnobotani kawasan masyarakat lokal desa truyan. *Jurnal Pendidikan:Teori,*

- Penelitian dan Pengembangan*, 1(4), 603-607. Retrieved from <https://media.neliti.com/media/publications/210743-pengembangan-buku-ajar-etnobotani-melalui.pdf>
- Daniel, F., & Taneo, P. N. L. (2019). Pengembangan buku ajar teori graf untuk meningkatkan kemampuan representasi matematis siswa pada mata kuliah matematika. *Jurnal Pendidikan Matematika: Edumatika*, 9(2), 64-70.
- Depdiknas. (2008). *Panduan pengembangan bahan ajar*. Jakarta: Direktorat Pembinaan Sekolah Menengah Atas.
- Dikti. (2009). *Pedoman memilih dan menyusun bahan ajar*. Jakarta.
- Fitriyati, U., Fachrunnisa R., & Hayuana, W. (2021). Tantangan dan peluang pengembangan mata kuliah keanekaragaman tumbuhan di era disrupsi dari perspektif calon guru biologi. *Jurnal Pendidikan Biologi*, 12(2), 90-98. Retrieved from <http://journal2.um.ac.id/index.php/jpb/article/view/19642/8067>
- Hadiyanti, N., Supriyadi., & Pardono. (2018). Keragaman beberapa tumbuhan ciplukan (*physalis spp.*) di lereng gunung kelud, jawa timur. *Berita Biologi Jurnal Ilmu-ilmu Hayati*, 17(2), 134-146. Retrieved from <https://doi.org/10.14203/beritabiologi.v17i2.3238>
- Liunokas, A. (2020). Analisis kemampuan mahasiswa dalam mengidentifikasi tumbuhan di lingkungan stkip soe. *Jurnal Inovasi Pendidikan dan Sains*, 1(1), 8-12. Retrieved from <https://doi.org/10.51673/jips.v1i1.220>
- Mahardika, I. K. (2011). *Pengembangan bahan ajar mekanika untuk meningkatkan kemampuan multipresentasi mahasiswa calon guru fisika*. Tesis Program Pasca Sarjana UPI: Tidak diterbitkan. Retrieved from http://repository.upi.edu/operator/upload/d_ipa_0809632_chapterI.pdf
- Mudlofir, A. (2011). *Aplikasi pengembangan kurikulum tingkat satuan pendidikan dan bahan ajar*. Jakarta: Raja Grafindo Persada.
- Nuraida, Dede & Nisa, UM. (2017). Pengembangan ensiklopedia morfologi, anatomi dan fisiologi pada tumbuhan berkarakter khusus. *Proceeding Biology Education Conference*, 14(1), 503-507. Retrieved from <https://jurnal.uns.ac.id/prosbi/article/viewFile/18484/14658>
- Pangastuti, A., Amin, M., & Indriwati, S. E. (2016). Pengembangan buku ajar biologi sel dengan pendekatan bioinformatika. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*, 1(2), 116-121. Retrieved from <http://journal.um.ac.id/index.php/jptpp/article/view/6105/2567>
- Prastowo, A. (2012). *Panduan kreatif membuat bahan ajar inovatif*. Jogjakarta: Diva Press.
- Puspita, M. A. (2014). Pengembangan media pembelajaran obstetri pediatri berbasis multimedia untuk penguasaan konsep kesehatan reproduksi. Repository UPI Edu. Univeristas Pendidikan Indonesia.
- Ramadan, R. R., Safei., Eka, D., & Jamilah. (2021). Strategi belajar overlearning menggunakan media edmodo dapat meningkatkan motivasi belajar biologi peserta didik. *Bioma: Jurnal Ilmiah Biologi*, 10(1), 30-43.
- Rezeqi, S., Wasis W. W. B., Dian H., & Abdul R. F. G. (2020). Analisis kebutuhan bahan ajar taksonomi organisme tingkat rendah terhadap capaian pembelajaran berbasis kkni. *Jurnal Pelita Pendidikan*, 8(2), 126-133. Retrieved from <https://jurnal.unimed.ac.id/2012/index.php/pelita/index>
- Sarjani, T. M., Mawardi., Ekariana S. P., & Devi W. (2017). Identifikasi morfologi dan anatomi tipe stomata famili piperaceae di kota langsa. *Jurnal IPA dan Pembelajaran IPA (JIPPI)*, 1(2), 182-191. Retrieved from <https://doi.org/10.24815/jipi.v1i2.9693>
- Sumaryani, N, Putri., & Nyoman, P.N. (2021). Pemberdayaan keterampilan proses sains biologi dengan memanfaatkan lingkungan sekitar sebagai sumber belajar di masa pandemi covid-19.

Jurnal Emasains: Jurnal Edukasi Matematika dan Sains. Retrieved from <https://doi.org/10.5281/zenodo.5607250>

Susilawati, Y., & Muhamad K. S. (2018). Keterampilan mahasiswa dalam mengidentifikasi tumbuhan di lingkungan universitas majalengka sebagai kompetensi mata kuliah morfologi tumbuhan. *Jurnal Bioedusiana*, 3(1), 29-37. Retrieved from <https://doi.org/10.34289/277887>

Utomo, B., Arif., Upik, Yelianti, Muswita, & Ervan J. W. (2018). Pengembangan e-book berbasis mobile learning pada mata kuliah struktur tumbuhan. *Bioedukasi: Jurnal Pendidikan Biologi*, 11(2), 93-104. Retrieved from <https://doi.org/10.20961/bioedukasi-uns.v11i2.23814>