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Developing Atlas of Ficus Plant Morphology Based on Local Potency of Bantimurung Bulusaraung National Park as Botany Learning Material in the College

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abstract

Learning based on local potential is a curriculum demand contained in the National Standards of Higher Education. One of the local potentials in the South Sulawesi region is Bantimurung Bulusaraung National Park with high biodiversity. There are 709 species of plants and among them, there are 43 types of Ficus plants that are key species in the area. This research aims to develop a plant morphology atlas based on the local potential of Bantimurung Bulusaraung National Park as botanical teaching materials in universities. Development adapts the stages of the ADDIE model. Research data in the form of qualitative data and quantitative data obtained from material experts, teaching materials development experts, education practitioners, and learners. The data obtained is then analyzed using the validity percentage formula. The validation of products with a value of 97.6% indicates that the plant morphology atlas of material aspects includes valid criteria. The taught material development apex obtained a value of 99.6% which indicates a very valid criterion. Based on the results of validation from education practitioners which is 76.7% and includes quite valid criteria. The results of the trial in a small group obtained a value of 84% with excellent validity. In conclusion, the atlas developed valid and practice as teaching material. So, this atlas can be used as a teaching material for supplements, especially in plant morphology courses in universities.

1. Introduction

Effective and efficient biology learning consists of a continuous process, namely planning, implementation, and assessment. The planning stage is an important foundation for the implementation of learning as a whole. Provision of learning resources is one form of planning in learning. Each path, level, and type of education requires learning resources in the learning process. Learning based on various sources is learning that takes place in the active interaction of students with various learning sources, not just learning which is only a passive and monotonous interaction from a student to a teacher (Rahmadi, 2017; Jufrida et al., 2018; Ali et al., 2019). Selection of learning resources must be based on needs analysis. Analysis of the need for learning resources must be carried out regularly and continuously considering that science, technology

and art continue to develop rapidly (Rahmadi et al., 2018; Nurramadhani et al., 2020; Hizqiyah et al., 2022).

One source of learning is teaching materials. Good teaching materials are teaching materials that are by the needs, characteristics of teaching materials, and according to the curriculum. Curriculum demands in developing teaching materials refer to Indonesian government regulations that curricula at all levels are developed on the principle of diversification according to educational units, regional potential, students (Susilanas & Herlina, 2018; Haryanto & Wulandari, 2019). Learning needs to internalize local excellence and wisdom to form a comprehensive mindset (Arisetyawan et al., 2021). One of the reasons for developing teaching materials is to identify the local potential of each region so that learning becomes meaningful and applicable. This is because the learning that is carried out is relevant to the lives and needs of students, besides this relevance makes it easier for students to practice their science skills (Ismiati, 2020; Hayati et al., 2019). This demand can be applied to every subject in college, one of which is the Plant Morphology course.

Concerning the characteristics of plant morphology course material that examines various forms of the external structure of a plant, a visual display in learning is very necessary, so that the teaching materials developed contain concrete pictures or illustrations of plants. One of the identification books in Indonesia is the book Flora by Van Steenis (2008). This book contains a detailed description of a plant but does not have adequate pictures. Based on these reasons, it is necessary to develop teaching materials that can visualize plant morphology material, one of which is a plant morphology atlas. The atlas that was developed contains original illustrations in the form of photographs of plant morphology that help make learning more concrete and facilitate the identification of plants that have played an important role since the 18th century. Illustrations that instruct foster acquisition of knowledge in the learner and are of particular value in helping a learner to build a mental model of how something works. So, visual appearance is very important in understanding an object (Leggett & Kirchoff, 2011; Mayer, 2019).

Several studies on the development of plant atlases in Indonesia (Azizah, 2016; Wulandari, 2022; Fatma, 2017). Azizah (2016) developed an atlas of moss plant diversity in R. Soerjo Forest Park. The atlas which was developed as teaching material in universities contains several photos of the morphological and anatomical structures of 30 species of mosses belonging to Hepaticopsida, Anthocerotopsida, and Bryopsida. Wulandari (2022) on the atlas of plant diversity of the Poaceae tribe examines the morphology of 20 species of Poaceae plants in the R. Soerjo Forest Park so that they can be used as supplementary teaching materials for universities. Fatma (2017) regarding the lichen atlas found 24 species of lichen foliose found in R. Soerjo Forest Park and carried out characterization in terms of morphology. The atlas developed in these studies is based on the local potential of the R. Soerjo Forest Park area.

The local potential is the potential of resources owned by an area specifically, whether in the form of natural, human, geographical, cultural, and historical. Natural resources are local potentials that can be used in the study of Biology learning. Learning Biology needs to utilize local potential because biology must be relevant to the lives and needs of students, besides that by studying local potential, learning becomes more applicable (Nurhidayati, 207; Ferry, 2019; Ismiati, 2020; Wati et al., 2022; Walid et al., 2022). One of them is Bantimurung Bulusaraung National Park (Babul National Park), which is a conservation area in South Sulawesi that can be used as a source of developing teaching materials.

The Babul National Park area has high biodiversity, including plant diversity. As of 2016, 709 plant species have been registered in the Babul National Park area. Several studies on plants in Babul National Park are related to butterfly feed plants, which are endemic animals. Suryanto (2014) studied butterfly feed plants and found *Nauclea orientalis* Merr. (Rubiaceae) and

Dracontomelon dao at Resort Bantimurung. Tambaru (2015) showed that the plant species in the butterfly breeding area of Babul National Park consist of 11 families, namely Caesalpiniaceae, Piperaceae, Rutaceae, Annonaceae, Aristolachiaceae, Asclepiadaceae, Papilionaceae, Bignoniaceae, Mimosaceae, Arecaceae, and Moraceae.

Based on the results of interviews at the Babul National Park Office, data obtained from one of the typical plants of the Babul National Park area is the Ficus plant. There are 43 species of Ficus which are key species because of the function of their fruit as the main food for various frugivores that inhabit this ecosystem such as mammals, birds, reptiles, and insects. The Ficus plant in Babul National Park has not been empowered by the local community. Meanwhile, people in several countries such as Africa and India have used Ficus plants for medicine, furniture, and other uses (Niangadouma, 2010; Achi et al., 2017; Ogunjobi et al., 2018; Salehi et al., 2021). Based on Hasanah et al. (2017), several types of Ficus plants found in Bantimurung Bulusaraung National Park have potential as medicinal ingredients, including the fruit of *Ficus botryocarpa* Miq. as anti-cancer, the root bark of *Ficus exasperata* Vahl as antimicrobial, leaves of *Ficus microcarpa* L.f. as an analgesic, anti-inflammatory and anti-diarrheal drug, the sap of *Ficus racemosa* Burm.f. as anti-diarrhea, and *Ficus variegate* Blume fruit has cytotoxic, antioxidant, and antibacterial activity.

Ficus plants have great potential for research resources in the development of teaching materials. Based on this, the Ficus plant in Babul National Park was used as an atlas study plant developed in this study. The development of local potential-based teaching materials is expected to be able to meet the demands of the curriculum. The product developed in this study is a morphological atlas of Ficus plants based on the local potential of Bantimurung Bulusaraung National Park as botanical teaching material in universities. This atlas serves as a means of plant identification and plays an important role in biodiversity conservation efforts through inventory and documentation of local plants.

2. Method

This research is development research using the ADDIE model (Analyze, Design, Develop, Implement, and Evaluate) (Branch, 2009). The ADDIE stages in this study are only three stages, those are Analyze, Design, and Develop. The Implementation and Evaluation stages were not carried out due to time constraints. This research is an R&D research, this can be seen in the morphological data collection of Ficus plant specimens which are then included as data in the development of teaching materials in the form of Atlas of Ficus plant morphology based on the local potential of Bantimurung Bulusaraung National Park.

The research during April-November 2016 was conducted in the Taman Nasional Bantimurung Bulusaraung area, located in Pattunuang and Karaenta Resorts, Maros Regency, South Sulawesi. Sampling of plants that will be used as specimens in making this atlas uses nature exploring techniques. The instruments used in the development of the atlas are 1) guidelines for observing plant morphology; 2) media validation sheet; 3) media practicality sheet; and 4) preliminary trial sheets.

The data obtained in the form of qualitative data and quantitative data are collected, analyzed, and inferred. Qualitative data includes comments and suggestions, while quantitative data is in the form of scale range values of 1-5. The categories are 1 = bad; 2 = not good enough; 3 = good enough; 4 = good; and 5 = Excellent. Quantitative data are analyzed in the form of percentages. Based on the analysis of the data obtained a percentage score determined by the criteria for assessing the quality of its validity. Validity criteria in terms of material refer to the criteria proposed by Sudjana (2012) and the criteria in terms of the development of teaching materials and readability by educational practitioners refer to the criteria proposed by Lestari (2020).

3. Result and Discussion

The results and discussion are written in one unit; the author is not justified based on the results and prior discussion in the form of a new chapter. How to write in the results and discussion is done directly by reviewing directly one by one, the research results obtained with relevant references and prioritizing from primary sources. The results of the study can be equipped with tables, pictures, and graphics to clarify the presentation of the research results verbally.

The local potential-based atlas teaching materials developed in this study refer to the ADDIE development model which consists of 5 stages, namely: Analyze, Design, Develop, Implement, and Evaluate. This study aims to produce atlas teaching materials that meet valid and effective criteria. However, in this study, the implementation stage was not carried out due to the distance factor and the time constraint factor. The evaluation stages are carried out at the end of each other's stages. The following are the results of research and descriptions of procedures for developing atlas teaching materials and their discussion, so that a valid and practical atlas is obtained.

Analyze Phase

Validate Issues

The analyze phase consists of several steps, namely 1) *validate issues*, observations show that there is no availability of teaching materials based on local potential and students have difficulty with the lack of knowledge of plants in Plant Morphology teaching materials. Another problem is that teaching materials are not equipped with clear photos or illustrations. 2) *Development goal setting*, teaching materials developed based on local potential with clear illustrations in the form of morphological atlases of *Ficus* plants in Bantimurung Bulusaraung National Park. Development of atlases to meet the learning demands and needs of students for the course of Plant Morphology. 3) *Target confirmation*, the target of the development of this atlas is students of the Plant Morphology course. Needs analysis to a number of students who have taken the Plant Morphology course shows the ability, experience, needs, and motivation towards the desired subject or target. 4) *Identify the necessary things,* the things needed in this development are photos of *Ficus* plants ranging from habitus to its main parts such as leaves, stems, roots, and sikonium. In addition to photos, a description of each *Ficus* plant species found is required as well as the results of identification verification from competent experts. 5) *Determination of the introductory system,* the right introductory system to overcome the problem is the development of atlas teaching materials. The selection of the atlas takes into account its function as a teaching material and its main characteristics in the aspect of photography. 6) *Preparation of development implementation plan (schedule)*, the implementation of development research consists of the exploration stage of the *Ficus* plant and the atlas product development stage.

Design Phase

The design phase consists of several steps, namely 1) *Component list preparation*, the components needed in product development consist of content components in the form of *Ficus* plant data, construct components in the form of a framework in the main discussion of the product to be developed, as well as design program components used in developing atlas products. The data of content component is in the form of plant identification results and descriptions equipped with morphological photos of *Ficus* plants found at the study site (Table 1).

Table 1 *Ficus* plant findings in Bantimurung Bulusaraung National Park

No	Species Names	Region Name	
1	*Ficus altissima* Blume	Makassar	: Kajuara ballusu
		Indonesia	: Ara pencekik
		Makassar	: Kajuara coppeng (hitam)
		Jawa	: Grasak, Benda oyod, Panggang, Wiyuyang, Yuyang
2	*Ficus annulata* Blume	Madura	: Krasak
		Sunda	: Kiara bodas, Kiara oneng
		Kalimantan	: Bulu, Ara susu
		Melayu	: Buntut, Kuap
		Makassar	: Kajuara kaleleng
3	*Ficus apiocarpa* (Miq.) Miq.	Kalimantan	: Entaban
		Makassar	: Lambere
4	*Ficus botryocarpa* Miq.	Sulawesi	: Tarera intalun
		Ambon	: Musur
5	*Ficus cinnamomea* Corner	Makassar	: Kalikenrang
		Makassar	: Kajuara coppeng (kuning)
6	*Ficus drupacea* Thunb.	Jawa	: Bulu timun
		Sunda	: Kiara gambir, Kiara wunuk
7	*Ficus exasperata* Vahl	Makassar	: Kajuara capuko
8	*Ficus gul* K.Schum. & Lauterb.	Makassar	: Kajuara pallasa
9	*Ficus insipida* Willd.	Makassar	: Kajuara lompo
10	*Ficus lacunata* Kvitvik	Makassar	: Karisa' batang
		Makassar	: Kajuara rampa'
11	*Ficus microcarpa* L.f.	Jawa	: Preh
		Melayu	: Jawi-jawi, Jejawi
12	*Ficus pisifera* Wall. ex Voigt	Makassar	: Kajuara pa'da
		Makassar	: Biraeng
13	*Ficus racemosa* L.	Jawa	: Elo, Loa
		Madura	: Arah
		Sunda	: Loa
14	*Ficus scortechinii* King	Makassar	: Tambung-tambung
		Makassar	: Tobo-tobo
		Bugis	: Dausalo
		Jawa Tengah & Belitung: Awar-awar	
		Madura	: Bar abar
15	*Ficus septica* Burm.f.	Sunda	: Kiciyat
		Minahasa	: Bei, Loloyan
		Ambon	: Sirih popar
		Ternate	: Tagalolo
		Halmahera Utara: Bobulutu	
16	*Ficus sinuata* Thunb.	Makassar	: Kajuara langnga-langnga
		Medan	: Rube-rube
17	*Ficus variegata* Blume	Makassar	: Marawallasa
		Jawa	: Gondang
		Sunda	: Kondang
		Madura	: Ghundang
		Bali	: Gondang
		Sumbawa	: Kandelu, Kanjilu
		Sulawesi Utara	: Latua, Matana, Naha, Sha, Toubukau
		Halmahera Utara: Toro	
		Ternate	: Goro
18	*Ficus virens* Aiton	Makassar	: Kajuara puca’

Next up is components of the atlas construct of *Ficus* Plant Morphology in Bantimurung Bulusaraung National Park. The atlas was developed into 4 main chapters. A list of references is

found in each chapter. The main chapter consists of Chapter I Profile of Bantimurung Bulusaraung National Park; Chapter II Get to know *the Ficus* Plant; Chapter III *Ficus* Plant Diversity in Bantimurung Bulusaraung National Park; Chapter IV *Findings of Ficus* Plants in Bantimurung Bulusaraung National Park. All components are put together and applied to the program design. Applications in developing atlas products are *Adobe Photoshop* for editing photos or images, Microsoft *Word* for processing words and book designs thoroughly, and *Microsoft PowerPoint* for designing covers.

The second step of design phase is 2) *Preparation of product development* objectives, this development research aims to produce products in the form of new valid and practical teaching materials that can be used as a supplement to student learning in botanical learning. 3) *Preparation of product validation and trial* instruments, the instruments compiled aim to determine the level of validity of the product being developed as well as test the readability of the developed product. Validation instruments are filled by validators from material experts, teaching material development experts, and field practitioners. The product trial instrument is intended for small groups of students.

Develop Phase

The develpo phase consists of several steps, 1) *Making products by design*, the components of the designed atlas are then put together and developed into a new product, namely atlas. The components consist of a front-back cover, a copyright note, a preface, a preface, a table-picture-table table of contents, a core section (Chapter I-IV), and a concluding section (glossary, index, and author biography). All of these components are designed and layout as needed. Some of the atlas views can be seen in Figure 1.

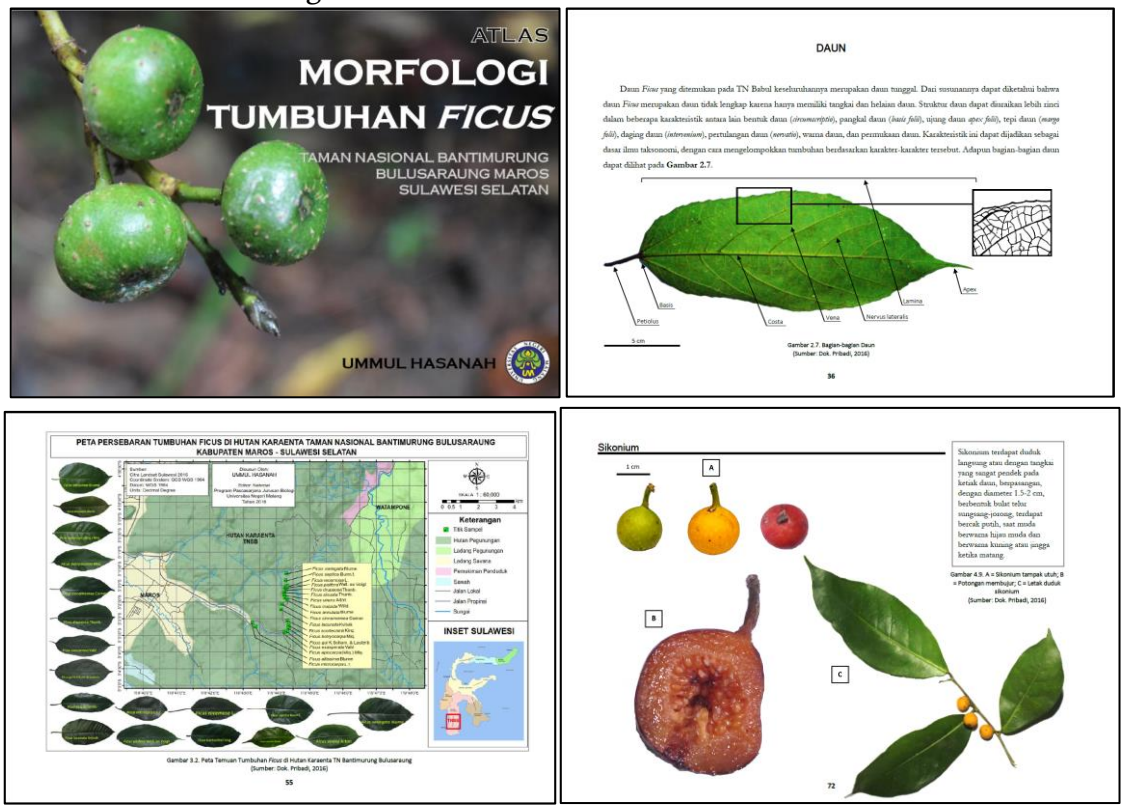

Figure 1. Atlas view

The next step is 2) *Selection of supporting media*, the use of print media, especially regarding the selection of paper will support the development of good quality products. The type of paper used in the development of this product is *art paper* that is able to provide sharp results. The cover uses

art paper 260 grams and the contents of the book use *art paper* 150 grams. 3) *Development of product instructions for use,* these instructions for use describe the function of each component so that the atlas can be used effectively and efficiently. 4) *Formative* revisions, development research studies based on validation of material experts, teaching materials development experts, and education practitioners.

Validity of material experts

The study of atlas material developed was validated by a material expert, namely one of the lecturers of plant development structure course at FMIPA, State University of Malang. Validation is carried out twice, until a very valid result is obtained. The results and analysis of material validation can be seen in Table 2.

Table 2 Results and analysis of material validation of *Ficus* Plant Morphological Atlas

No	Aspects	Number of Indicators	Maximum Score	Validation Score	P (%)	Qualification
1	Conformity of atlas with the principle of teaching material development	2	10	10	100	Very valid
2	Content eligibility	35	175	152	98.3	Very valid
3	Readability	11	55	52	94.5	Very valid
	Total	48	230	214	97.6	Very valid

Table 2 shows the three aspects of assessment. The first aspect is the conformity of the atlas with the principle of teaching material development has a percentage value of 100% with very high atlas qualification, so the atlas is worth using. The second aspect is that content eligibility has a percentage value of 98.3% with very high qualifications, which means the atlas is worth using. The third aspect is readability which earns a percentage of 94.5% with very high qualifications and the atlas is worth using. A thorough assessment shows a percentage of 97.6%, so atlas material is worth using. Material experts also provide advice and comments on the atlas, among others: 1) the writing of the atlas title needs to be added the word "South Sulawesi"; 2) the arrangement of materials needs to be arranged more closely; 3) improvement of scientific name writing; 4) giving manual illustrations on leaf veins.

Validated atlas material relating to the accuracy and truth of the content submitted. Validation of the material is assessed from several aspects 1) Conformity with the principles of teaching materials development; 2) Content eligibility; 3) Readibility. The explanation of each aspect is as follows.

The Atlas of Plant Morphology of Ficus was developed by the learning outcomes of plant morphology subjects, but not thoroughly. Atlas is a nontext textbook with characteristics not directly related to the part of one of learning outcomes but still related to the main teaching material (Setyanto et al., 2016; Setiawati et al., 2019). The learning outcomes of the plant development structure course related to the development of this atlas are "Students are able to analyze the morphological structure of roots, stems, leaves, flowers, fruits, and seeds of flowering plants". Atlas development refers to the principles of teaching material development, namely the principles of relevance, consistency, and adequacy(Risdawati, 2018). The principle of relevance is the existence of material related to the achievement of learning outcomes. The principle of consistency is the conformity between competence and teaching materials. The principle of adequacy, which is a teaching material developed sufficiently to achieve the competence taught.

The content eligibility is related to the truth of the concept, the updating of the material, completeness of information, and useful to add insight. All of these sub-components support the validity of the developed media. The following is presented an explanation of the relationship between the sub-components and the media that has been developed. Based on *the truth of the concept*, is about the morphology of *the plant Ficus*. *The latest material*, i.e. material delivered by the development of science, using the latest references, as well as recent examples or illustrations

(Suhartanto, 2008; Laisaroh et al., 2015). This atlas was developed from the results of actual research related to *the Ficus* plant, which was studied using the latest references. Atlas has a major feature with its illustration dominance. The illustration consists of photos taken from the research site as well as manual illustrations. *The completeness of information*, this atlas is equipped with the required information related to the material. In addition to containing primary information, the atlas also features secondary information that is not obtained in the field, such as a literature review of the potential of each *Ficus* plant found. Some of *ficus plants'* potential in medicine as anti-cancer, anti-microbial, analgesic, anti-inflammatory, anti-diarrheal, and antioxidant (Ramutton et al., 2013; Lawal et al., 2009; Bairagi et al., 2014; Bheemachari et al., 2007; Rijai, 2013). In the atlas, there is also a "Did you know?" box. This box contains unique information related to the *Ficus* plant. This information complements each other and produces a good quality atlas. An example is about the largest tree in the world, namely *The Great Banyan* (*Ficus benghalensis* L.) found in Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah, India (Atlas Obscura, 2016). The extent of the tree due to the large number of air roots that develop into supporting roots and expand the growing area of *Ficus benghalensis* L.

The last sub-component is about *the useful add insight*. Atlas contains information related to the morphology of *Ficus* plants in Bantimurung Bulusaraung National Park. In addition to *ficus* plants, readers increase their knowledge about plants in one of the local potentials of South Sulawesi, namely Bantimurung Bulusaraung National Park. This is in accordance with Permendikbud No. 49 of 2014 on National Standards of Higher Education that learning needs to review local excellence and wisdom to encourage the development of a comprehensive and broad mindset. Learningthat focuses on local potential where learners are involved with the conditions in their environment will create contextual learning (Haryanto, 2018). Learning thatis adapted to environmental conditions actively students will construct their own knowledge based on experience and knowledge that previously existed so that later new understandings are created which will then increase student motivation in the learning process (Sari, 2020).

The last aspect of validation of material expert is readability. Readability is related to the ease of reading and understanding a text. Readability can be influenced by sentence length, word selection, term, layout, suitability of the title with image caption/illustration, conformity of illustration with concepts, and the archival of illustrations. The content of the atlas was developed using a combination of images and text. Where is the arrangement of the two in proportion. An image of an excellent size to observe that is accompanied by an image caption as an image explainer. The text is not too much and not too tight by using the typeface Calibri for the title and Garamond for the body text. Calibri is a sans serif typeface suitable for the use of headings and Garamond is a serif typeface suitable for text bodies (Bylinskii, 2009). In addition, the selection of paper will support the development of good quality products. The type of paper used in the development of this product is art paper which is able to provide sharp results.

Validity of teaching materials development experts

Aspects of the development of atlas teaching materials developed were validated by one of the media lecturers from the Faculty of Education Technology, Malang State University. Validation is carried out once, until a very valid result is obtained. Summary of results and validation analysis of teaching material development can be seen in Table 3.

Table 3 Results and validation analysis of teaching materials development of *Ficus* Plant Morphological Atlas

No	Aspects	Number of Indicators	Maximum Score	Validation Score	P (%)	Qualification

1	Book size	2	10	10	100	Very valid
2	Book cover design	15	75	74	98.7	Very valid
3	Book content design	27	135	135	100	Very valid
	Total	44	220	219	99.6	Very valid

Table 3 contains three aspects in the assessment of the development of teaching materials. The first aspect is that the size of the book has a very high 100% percentage value of atlas qualification, so the atlas is very feasible to use. The second aspect is that the book cover design has a percentage value of 98.7% with very high qualifications, which means the atlas is very worth using. The third aspect is readability which earns a 100% percentage with very high qualifications and atlases are very suitable for use. The overall assessment shows a percentage of 99.6%, so in terms of the development of teaching materials, atlas is very feasible to use.

Atlas as a product of development is validated with regard to its graphic elements. The radiography of teaching materials consists of systematics and the appearance of teaching materials. This validation is assessed from several aspects, those are book size, book cover design, and book content design.

Book Size. Atlas is printed on B5 (176 mm x 250 mm) paper. Book size refers to international paper standards ISO, International Organization for Standardization (A4, B5, A5, and so on). (Pambudiono et al., 2016) stated a minimum size of A5 (148 mm x 210 mm) for teaching books. This atlas is dominated by illustrations so it uses paper sizes larger than A5 so that the image is clear but still easy to carry and read. Based on these considerations the atlas is printed on B5-sized paper which is the size of the paper that is between A5 and A4. The thickness of the book reaches 150 pages. This is in accordance with the content of the material from the atlas.

Book cover design. Book covers are the first thing that prospective readers see and can spark the curiosity of prospective readers, making them the best promotional tool for the book (UNESCO, 2014). A good cover conveys the essence of the book, which is readable, the message clear, and aesthetically appealing (UNESCO, 2014). Designing an effective cover requires preparation and some concepts. Based on this, the assessment of book cover design consists of several sub-components of assessment, namely layout, typography, and book cover illustration.

The layout of the book cover is concerned with the alignment of the cover to the elements that make up the cover. The placement of image elements (including logos) and typography must be in their respective spaces in order to create a good layout. These elements are important elements, but they are not the same weight. It is important to set the layout precisely taking into account the size, sharpness, and color selection of each element that builds it. According to (UNESCO, 2014), cover alignment is a product of graphic composition which is an important factor for delivering clear and strong results. Graphic composition consists of the balance between spaces as well as the proportion of images to typography.

Book cover typography is related to the elements of the letters that built them. The title of a book should not use decorative letters to make it easy to read. The title writing and author of this atlas uses a type of Copperplate Gothic font. This type of *font* is interesting and easy to read because it uses colors and effects that contrast with background image elements. The title size of the book is made more dominant than the name of the author so that the reader can focus more on the title. The text of the description on the back cover is written using the Calibri font type. The use of this type of *font* gives a minimalist impression on the text and is easy to read.

Book cover illustrations are made to a minimum. The illustration on the cover presents the face of the *Ficus* plant. The illustration is shown in the form of a photo of the iconium from *Ficus botryocarpa* Miq. which is one of the characteristics of *the Ficus* plant. According to (UNESCO, 2014), that the illustration on the cover can carry the character of the contents of the book. The image displayed is a single image to provide focus and clarity on the atlas cover. (UNESCO,

2014) mentions a single image is better than a composition of five images, because simplicity makes readability and visual ease better. This photo was taken from the research site so that it displays objects according to reality. Photo utilization can display the real effects of the original object (Newfield, 2011). This illustration is contained on the front and back cover. Illustration on the back cover is given an artistic *cutout* effect to make it more varied.

Book content design. The design of the contents of the book is well designed so that prospective readers are interested and do not get bored when reading it. The book content design assessment consists of several sub-components of assessment, namely layout, typography, and illustration of the contents of the book.

The layout is related to the margin and pattern of laying elements of the contents of the book so as to facilitate the understanding of the contents of the book. The book consists of three main parts, namely the introduction, the core part, and the closing part. Each section is designed with a different layout, both in terms of shape, color, and size of the content elements to emphasize the boundaries of each part. The layout of each section is designed consistently and equally. Atlas is equipped with illustrations. Illustrations are placed with a suitable and attractive layout. In addition, illustrations come with supporting text or captions. Supporting text assists illustration in conveying the message (Newfield, 2011). The placement of supporting text and captions is consistently designed to facilitate the reader's understanding.

Typography is the art of selecting and structuring letters with their dispersal arrangements in available spaces, thus creating an impression on the reader. (Suwardjono, 2008) mentions that typography is very closely related to the problem of readability, namely the level of visual comfort of prints so that the reader is durable enough to read because the eyes do not experience fatigue. In typography, letter design is classified into two types, namely *serif* (tailed), for example Times New Roman and *sans serif* (without tail), for example Arial.

Typographically, *serif* typefaces are designed with letters that form a word fused so as to allow for quick reading. If the sans *serif* typeface is used for the body of the text, it will reduce the level of readability and the eyes become tired from having to scan the letters into words. *Sans serif* is more suitable for the title because it features an aesthetically pleasing face (Suwardjono, 2008). The typeface that is widely used as the title in the contents of the atlas is Microsoft Sans Serif which is classified as the letter sans serif. As for the body of the text, more use the Garamond typeface which is classified as serif letters. According to (Wood, 2012), garamond typeface is one of the best letters used for print media because it has a high level of readability.

The writing of the title hierarchy as well as the body of the text must be consistent. Both in terms of placement patterns, typefaces used, and the use of spaces between lines of text arrangement. In addition, the paragraph text that is compiled should not have a white flow due to the distance that is too wide. A distance that is too wide can cause problems of readability or comfort of the reader. The white flow is concerned with the selection of the type of justification of a paragraph. Justified or left-right average can be used when there is no distance that is too far between words. Usually the writing displayed on the left-right average is intended to bring a formal, official, rigid, objective, interpersonal, and serious impression (Suwardjono, 2008). While align left is intended to carry an informal, relaxed, personal, familiar, and emotional message (Suwardjono, 2008)). Atlas is developed using both types of justification. Chapters 1 through Chapter 3 use justified formats to give a formal impression to this atlas, while in Chapter 4 which is the main part of the atlas uses *the align left* format. The selection of *align left* at the core is intended to make the reader more relaxed and give a familiar and emotional impression.

Illustration as a visual display is the main feature of atlases. The illustration is dominated by photos showing the morphology of *the Ficus* plant. The use of prominent visual displays is expected to improve the visual literacy of the reader. There is a correlation between the quality of

visual media and visual literacy, where when the quality of visual media is high, visual literacy will be high as well. (Lai, 2010) revealed that learners' visual literacy skills even have an effect on lifelong critical thinking skills. (Putri & Astuti, 2014) explained that the role of illustration is important as a companion to the contents of the book that explains a text because there is a text that can stand alone and there is also a text that needs the help of illustrations to clarify its meaning. Photo illustrations on the atlas are accurately displayed by adding a scale comparison with the original size. This gives the reader information and an idea of the actual size.

Validity of educational practitioners

The atlas developed is also validated by the education practitioners, which is one of the lecturers of Biology of Makassar State University. Summary of the results and analysis of educational practitioners can be seen in Table 4.

Table 4 Results and validation analysis of educational practitioners of *Ficus* Plant Morphological Atlas

No	Aspects	Number of Indicators	Maximum Score	Validation Score	P (%)	Qualification
1	Language	4	20	15	75	Quite valid
2	Readability	3	15	12	80	Quite valid
3	Presentation	4	20	15	75	Quite valid
4	Appearance	4	20	15	75	Quite valid
5	Benefit	3	15	12	80	Quite valid
	Total	18	90	69	76.7	Quite valid

The overall assessment shows a percentage of 76.7%, so in terms of educational practitioners, the atlas is quite valid and can be used with a slight revision. The advice of education practitioners is about the systematic preparation of materials and consistency of image caption placement. The advice given is reviewed and changes are made to the atlas product. The atlas, which was assessed, showed inconsistent image caption placement. Practitioners are confused by the caption of the picture in question. Based on these suggestions, image captions are placed consistently in the same place making it easier for readers to understand. Based on validation results, there are several musts that are assessed, namely language, readability, presentation, appearance, and benefits.

Language. The language aspect is related to the delivery of information, the use of sentences, and the use of words and terms. A good atlas describes information with sentences and terms that are easy to understand. According to Waridah (2008) the term consists of two, namely general terms and special terms. A general term is a term derived from a particular field, which is widely used so that it becomes a general vocabulary element. A special term is a term whose meaning is limited to a specific field only. The use of the term general in this atlas does not need to be equipped with its understanding, because it has become a common vocabulary that readers understand. The term specifically related to plant morphological material is explained in the text as well as in the glossary. This atlas uses scientific terms of biology related to plant morphology. In the content there is no mention directly related to its meaning, so it is this factor that can be the cause of its validity in the category of "quite valid". Although the author has actually listed it in other chapters and in the glossary at the end.

Readability. The aspect of readability is related to the element of its radiography. Atlas is easy and interesting to read if the typography application is right. Typography has been explained in previous discussions. As for the readability assessment, it is in the category of "quite valid" it can be caused because the size of the writing is not too large so that it is poorly readable.

Presentation. Atlas must have a good delivery of material to make it easier for readers to understand the contents. The morphological atlas of *the Ficus* plant is arranged over four main languages with deductive patterns. Chapter 1 on the profile of the research site, Chapter 2 on the

morphology of *ficus* plants in general, Chapter 3 introduces the diversity of *Ficus* that has been recorded at the research site, and Chapter 4 discusses in detail the findings of *ficus* plants. Atlas contains additional interesting information. For examplein Chapter 2 about the information of *ficus* plants in India as the largest tree in the world. The information relates to the morphological character of the *ficus* plant described. The existence of interesting examples can motivate you to read more. However, although the atlas already has these components, but due to the inconsistent placement of image captions leads to presentations that are only in the category of "quite valid".

Appearance. The display is the first thing that becomes an attraction for the reader. A good display design will generate interest in learning. The atlas display is supported by illustrations with clear resolution and interesting colors. In addition to illustrations, the layout of the title, text and image captions must also be proportionate. However, although the atlas already has these components, but due to the inconsistent placement of image captions leads to appearance that are only in the category of "quite valid".

Benefit. Atlas should benefit its readers. Atlas is used as a supplement teaching material in the subjects of Plant Morphology so as to add insight and increase the curiosity of its readers. Learning Biology needs to utilize local potential because biology must be relevant to the lives and needs of students, besides that by studying local potential, learning becomes more applicable (Ismiati, 2020); Nurhidayati, 2017). *Ficus* plants that appear to be tree plants in general and the absence of an attractive flower display result in readers being less interested and the validity of being in the category of "quite valid".

These aspects work together to produce atlases that are easy to use, interesting, and useful to their readers. Based on these aspects, the assessment shows a percentage of 76.7%, so the atlas is quite valid and can be used with minor revisions. The advice of education practitioners is about the consistency of image caption placement. Based on these suggestions, image captions are placed consistently in the same place making it easier for readers to understand. The preliminary trial as the last step of develop phase aims to test the readability of the developed atlas. Atlas was tested on 23 students who had studied Plant Morphology. Summary of preliminary trial results in Table 5.

Table 5 Preliminary Trial Results and Analysis of *Ficus* Plant Morphological Atlas

No	Aspects	Number of Indicators	Maximum Score	Validation Score	P (%)	Qualification
1	Language	4	460	358	78	Valid
2	Readability	3	345	288	83	Very valid
3	Presentation	4	460	384	83	Very valid
4	Appearance	4	460	409	89	Very valid
5	Benefit	3	345	30	87	Very valid
	Total	18	2070	1739	84	Very valid

Table 5 contains five aspects of the assessment of educational practitioners. The first aspect is that language has a percentage value of 78% with valid qualifications and can be used with a slight revision. The second aspect is that readability has a percentage value of 83% with very valid qualifications and atlases can be used without revision. The third aspect is the presentation which obtains a percentage of 83% with a very valid qualification and the atlas can be used without revision. The fourth aspect is appearance, with a percentage of 89% which means the atlas is very valid and can be used without revision. The fifth aspect is benefits with a percentage of 87%. This means the atlas is very valid, so it can be used without revision. The overall assessment shows a percentage of 84%, so in terms of atlas trials it is very valid and can be used without revision.

Preliminary trials of small groups of students use the same assessment instruments as educational practitioner validity instruments. Aspects assessed in the preliminary test are language, readability, presentation, appearance, and benefits. Based on the validation and trial stages showed the atlas has the following advantages and disadvantages.

This atlas highlights the local potential in South Sulawesi, where *the ficus* plant morphology atlas examines the *Ficus* plant found in Bantimurung Bulusaraung National Park. So, the study of local potential can create holistic learning. Atlas provides the main space for illustration, either in the form of photos or images. This illustration display can develop the visual literacy skills of learners and even have an effect on lifelong critical thinking skills (Lai, 2010). Atlas features a description of the photo displayed, where supporting text can help photos in conveying messages (Newfield, 2011). Books equipped with images can increase students' interest in reading and mastery of biology concepts. Increased interest in reading students in learning a learning material will also improve student learning outcomes (Meiningsih et al., 2019; Pralisaputri et al., 2016).

The existence of some images that are less clear, due to improper shooting techniques. This is because researchers are less trained in shooting techniques. The use of photos can display the real effects of the observed object (Newfield, 2011). Researchers lack basic knowledge about the object to be studied so, there is still less data related to the object studied. This results in the information submitted incomplete and still needs further development by researchers or researchers, especially in flower observation.

4. Conclusion

Development research uses the ADDIE model (Analyze, Design, Develop, Implement, Evaluate). Atlas validity tests developed from materials experts and teaching materials development experts fall into the category of very valid. The practicality test of the education practitioner is quite valid and the practicality test of the learners is very valid. So it can be concluded that this atlas that has been developed is worthy of use in plant morphology learning as a learning supplement. Based on this, it is better to learn based on local potential so that learning is more meaningful and applicable.

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