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## The practicality of popular scientific book of aquatic plant on mangrove habitat in the form of flipbook to college students' critical thinking skill

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### Abstract

In the 21st century, critical thinking skills are one of the essential abilities that greatly influence the academic and professional success of students. One of the learning resources that can train students' critical thinking skills is a learning resource that contains local potential. One of the learning resources that can be developed based on local potential is popular scientific books that are in accordance with the characteristics of critical thinking skills which are packaged in flipbook form to make it easier for students to access during the current pandemic. Popular scientific books (BIP) with the characteristics of critical thinking skills that were developed to overcome the problems of students' critical thinking skills. This study aims to describe the practicality of popular scientific books on aquatic plants in mangrove habitats in the form of flipbooks on students' critical thinking skills. The practicality data of BIP in the form of a flipbook was obtained from a one to one test to determine student readability using a readability questionnaire, small group test and field test to determine the practicality of expectations and actual practicality using a student response questionnaire and the results of observing the implementation of BIP use using an implementation questionnaire. This study uses a development research design with an EDR model through formative evaluation from Tessmer. Respondents are students who have passed the Plant Botany course program. The data analysis used descriptive categorization technique.

#### Abstrak

Di abad 21, keterampilan berpikir kritis merupakan salah satu kemampuan esensial yang sangat berpengaruh terhadap kesuksesan akademik dan profesional mahasiswa. Salah satu sumber belajar yang dapat melatih keterampilan berpikir kritis mahasiswa adalah sumber belajar yang memuat potensi lokal. Sumber belajar yang dapat dikembangkan dengan berbasis potensi lokal salah satunya adalah buku ilmiah populer yang sesuai dengan karakteristik keterampilan berpikir kritis yang dikemas dalam bentuk *flipbook* untuk memudahkan mahasiswa dalam mengakses pada masa pandemi saat ini. Buku ilmiah populer (BIP) dengan karakteristik keterampilan berpikir kritis yang dikembangkan untuk mengatasi permasalahan keterampilan berpikir kritis mahasiswa. Penelitian ini bertujuan untuk mendeskripsikan kepraktisan buku ilmiah populer tumbuhan air pada habitat mangrove berbentuk *flipbook* terhadap keterampilan berpikir kritis mahasiswa. Data kepraktisan BIP berbentuk *flipbook* didapatkan dari uji *one to one* untuk mengetahui keterbacaan mahasiswa menggunakan angket keterbacaan, uji *small group* dan uji *field test* untuk mengetahui kepraktisan harapan dan kepraktisan aktual dengan menggunakan angket respon mahasiswa dan hasil observasi keterlaksanaan penggunaan BIP menggunakan angket keterlaksanaan. Penelitian ini menggunakan desain penelitian pengembangan dengan model EDR melalui evaluasi formatif dari Tessmer. Responden merupakan mahasiswa yang sudah lulus program mata kuliah Botani Tumbuhan. Analisis data menggunakan teknik deskriptif kategorisasi.

## A. Introduction

The development of learning resources has a major contribution to the success of the learning process on campus (Subiyakto & Mutiani, 2019). One example of developing innovative and interesting learning resources is to use the local environment or based on local resources because local resources can support the success of community-based off-campus education programs. In line with Prastowo (2015) which states that the development of innovative and interesting learning resources is very important.

Environmental education can be used to measure critical thinking skills through the Critical Thinking Test of Environmental Education (CTTEE), namely making conclusions, inferences and identifying. When learning is designed using constructivist models, higher order thinking skills such as critical, creative, collaborative and communicative thinking can be trained properly. Learning based on critical thinking skills (KBK) is very helpful for students in mastering the competencies set by education and industry.

One example of teaching materials, namely popular scientific books in the form of flipbooks, can be used to improve critical thinking skills, namely books that meet several criteria. Books that lead to the implementation of knowledge and life experiences are very important, especially in improving critical thinking skills. Plomp & Nieveen (2007) state that teaching materials with these criteria include valid, easy to use (practical), and have broad and effective benefits in learning.

Some of the problems experienced by educators are the lack of teaching materials such as popular scientific books based on the local potential of an area, especially those developed in the form of flipbooks in an effort to minimize lag in the rapid advancement of information and communication technology (ICT). Popular scientific books in the form of flipbooks are books that contain knowledge based on research results that are presented scientifically using simple, concise and clear language so that they are easily understood by the public and students (Utami et al., 2017).

One of the environments that can be used as a learning resource is the mangrove forest. Mangrove forests are vegetation of plant species located in river mouths that are influenced by tides and have the ability to withstand high salinity (Utami et al., 2017; Fajeriadi, 2021).

Sukardjo (1996); Warpur (2016); Talib et al. (2021) define mangrove forest as a group of plants consisting of various types of plants from different families, but have the same morphological and

physiological adaptability to habitats influenced by tides. This is certainly a big enough potential for the development of a popular scientific book in the form of a flipbook that contains local potentials, especially mangrove aquatic plants. Apart from providing additional information, this also helps in maintaining and introducing local potential that exists in South Kalimantan in general, and in particular in Sungai Bakau village, Kurau sub-district, Tanah Laut district.

Aquatic plants have the potential to be developed as a source of learning, moreover the topic of aquatic plants in mangrove habitat is still very little raised for research, especially at Lambung Mangkurat University. In addition, the most widely used teaching materials are printed teaching materials, because they are easy to use, anytime and anywhere. In line with the rapid development of ICT, it has an impact on lifestyles that want to be fast-paced in meeting the need for information. As a result, various practical advanced technology devices have emerged to fulfill this enthusiasm, such as electronic books or better known as e-books.

Based on the explanation above, the development of popular scientific books in this study aims to describe the practicality of popular scientific books on aquatic plants in the form of flipbooks on students' critical thinking skills.

## B. Material and Method

The type of research used is development research, with the Education Design Research (EDR) model through Tessmer's (1998) Formative Evaluation. This development research is only focused on preliminary research and formative evaluation to produce a popular scientific book in the form of a practical flipbook.

Preliminary research was conducted to obtain the initial product, namely the BIP (flipbook) "Aquatic Plants in Mangrove Habitat". Then the initial product design was developed through formative evaluation according to the Tessmer model (1998) with individual tests to determine the practicality of the content, small group tests to determine the practicality of expectations and large group tests to determine the actual practicality obtained. The technique of collecting data on the practicality of BIP of aquatic plants in the mangrove habitat in the form of a flipbook on students' critical thinking skills is as follows:

- 1) Practicality of content to determine student readability of BIP in the form of a flipbook obtained through the opinions of 3 students in

an individual test categorized based on the criteria of practicality of content.

- 2) The practicality of expectations for determining student responses obtained through the opinions of 3 students in the small group test which is categorized based on practicality criteria.
- 3) Actual practicality to determine student responses obtained through the opinions of 15 students on the field test which were categorized based on practicality criteria.
- 4) The implementation of the use of BIP is carried out by 5 observers.
- 5) Students' critical thinking skills are carried out through practicum using a practicum guide and answering evaluation questions using the critical thinking skills rubric. Categorized based on n-gain criteria.

The data on the practicality of popular scientific books that were developed were obtained from data on the practicality of content, practicality of expectations and actual as well as the implementation of the use of popular scientific books as follows.

### 1. Practical content, expectations and actual

The practicality data measured using categories from (Ramadhan et al., 2020) are presented in Tables 1 and 2.

**Table 1 The category of content practicality assessment**

Percentage (%)	Criteria
80 < x ≤ 100	Very good
60 < x ≤ 80	Good
40 < x ≤ 60	Quite good
20 < x ≤ 40	Less good
0 < x ≤ 20	Not good

Source: Ramadhan et al. (2020)

**Table 2 Category of expectation and actual practicality assessment**

Percentage (%)	Criteria
80 < x ≤ 100	Very practical
60 < x ≤ 80	Practical
40 < x ≤ 60	Practical quite
20 < x ≤ 40	Less practical
0 < x ≤ 20	Not Practical

Source: Ramadhan et al. (2020)

### 2. Implementation of Product Use

Data on the results of the implementation of product use using the implementation instrument were analyzed descriptively by averaging the results of the scores for each

aspect of the assessment by observers with a modified formula from Sugiono (2015):

$$\bar{x} = \frac{\sum X}{N}$$

Description:  
 $\bar{x}$  : Mean score  
 $\sum X$  : Total score  
 $N$  : Total aspect

The results of the implementation are measured by the modified category from Sugiono (2015) which is presented in Table 3:

**Table 3 Product implementation categories**

Percentage (%)	Criteria
85.00 - 100	Very good
65.00 ≤ 85.00	Good
50.00 ≤ 65.00	Less good
≤ 50.00	Not good

Source: Modified from Sugiono (2015)

Students' critical thinking skills before and after learning using popular scientific books were also analyzed through the following steps:

- 1) Students' critical thinking skills are obtained from the results of formulating questions, identifying assumptions, making problem solutions, analyzing arguments and drawing conclusions.
- 2) Student scores are obtained by looking at student test results individually. This assessment uses a rubric with a score of 1-4, then calculated by the following formula:

$$\text{Student grades} = \frac{\text{Total score obtained}}{\text{maximum score}} \times 100\%$$

**Table 4 Categories of student KBK scores**

Percentage (%)	Criteria
85 < x ≤ 100	Very good
65 < x ≤ 85	Good
50 < x ≤ 65	Less good
≤ 50	Not good

Source: Modified from Sugiono (2015)

The amount of increase in learning outcomes is calculated using the gain formula by Hake (1999) as follows:

$$g = \frac{S \text{ after} - S \text{ before}}{S \text{ maximum} - S \text{ before}}$$

**Table 5 Classification of N-Gain**

g nilai value	Criteria
g > 0.7	High
0.7 > g > 0.3	Medium
g < 0.3	Low

Source: Hake (1999)

## 1. Results and Discussion

The practicality of the popular scientific book on aquatic plants in the mangrove habitat in the form of a flipbook that was developed showed that students responded very positively when using the BIP of aquatic plants, students were also greatly helped in learning, especially to identify aquatic

plants. This is also evidenced by the results of practicality of content on the readability test of students who get scores with very practical criteria as in Table 6, the results of practical expectations on small group tests and actual practicality on large group tests which also get scores with very practical criteria as in Table 7.

Table 6 Student readability test results

Aspect	Student Assessment			Mean score
	M1	M2	M3	
1. Every part learned is easy to understand	4	4	4	4,00
2. Instructions for using the book and how to carry out tasks are clear	4	3	3	3,33
3. The whole book is complete in logical order	4	4	4	4,00
4. The words used are easy to understand	4	4	4	4,00
5. The picture quality is good and the meaning can be understood	4	3	4	3,67
6. No typos or grammar errors found	3	4	3	3,33
7. The photo on the cover is clear and understandable	4	4	4	4,00
<b>Percentage (%)</b>				<b>94,03</b>
<b>Criteria</b>				<b>Very good</b>

Source: Results of data processing

The results of data processing on student readability results are as in Table 6 above with an overall percentage of 94.03 with a very good category or can be used without revision. Some aspects get imperfect scores, such as in aspect 2 regarding instructions for using books and how to carry out tasks with an average score of 3.33. This is because the instructions for using the books contained in the BIP were developed only in general, not in detail and clearly. In addition, aspect 6 regarding typos or grammar also got an average score of 3.33. This is because there are still some words that have typos by the author.

The development of the BIP was carried out very well, especially in the development of the material contained in it, coherently in accordance with the established procedures, and has been adapted to various existing aspects so that the results of the development of the BIP have various advantages. This is evidenced by the reinforcement test which gets the percentage in the very good category.

Individual tests or readability tests are very important to do so that popular scientific books that have been developed are in accordance with the conditions of students or readers who will use them in real learning in the field. Researchers also present material or concepts in a sequential and systematic manner in the BIP so that it makes it easier for readers to understand the content of the material. This is in line with Fajrin et al. (2014) which states that individual tests are carried out so that the message or content of the reading can be accepted by the reader as intended by the author.

Student responses were obtained from a small group test conducted by 3 students to obtain expected practicality data and a large group test conducted by 15 students to obtain actual practicality data. The student subjects who were asked were undergraduate students of Biology Education who had passed the subjects of low plant botany and higher plant botany. Student responses were assessed based on the criteria of very practical, practical, quite practical, less practical and impractical. Based on the results of the questionnaire, the student responses showed a very positive response to the BIP of aquatic plants in the form of a flipbook that was tested. The practicality of expectations with a percentage of 80.67 and actual practicality with a percentage of 91.33 shows that the acquisition of the two data is included in the very practical criteria to be used as shown in Table 7.

The positive response of students to BIP was created because at the development stage they had paid attention to various aspects, one of which was to adjust the presentation and appearance of the material to be easily understood by readers. The positive response shown by students is in line with the opinion of Masita & Wulandari (2018) which states that practicality refers to the level of users who consider the intervention so that it can be used and preferred under normal conditions. In addition, to measure the practicality of BIP, it is also seen whether the author considers that the material is easy and can be used by students and the general public. Dharmono et al. (2019) also states that the presentation of material in teaching materials accompanied by pictures associated with

knowledge and adapted to student experience can improve students' critical thinking skills in learning. Therefore, the results of students' positive responses to learning using BIP of aquatic plants in flipbook-shaped habitats are expected to improve students' critical thinking skills.

The implementation of popular scientific books is one of the data to measure the practicality

of BIP for aquatic plants. This data was obtained from 5 observers who observed the entire practicum activity and wrote down the results of their observations on the observation sheet provided. The results of observations on the implementation of BIP for aquatic plants in the form of a flipbook can be seen in Table 8.

**Table 7 Expected and actual practical results**

No.	Statement	Practicality	
		Hope	Actual
1	Popular Scientific Books motivate me to study.	4,00	4,53
2	I can learn actively and independently with this book.	4,00	4,53
3	The material presented can be understood easily.	4,33	4,80
4	Books are very interesting and not boring when used.	4,33	4,80
5	If the use of the book is carried out like this, the concepts from the lesson material can be remembered easily and for longer.	3,67	4,40
6	The use of this book can help solve problems in everyday life related to learning topics.	4,33	4,60
7	The use of this book has broadened my horizons.	4,00	4,67
8	I can understand the material with the help of good quality pictures.	4,33	4,60
9	I can study according to the needs of independent study.	3,67	4,20
10	Learning by using this book can help me develop critical thinking skills.	3,67	4,53
<b>Percentage</b>		<b>80,67</b>	<b>91,33</b>
<b>Overall percentage</b>		<b>86,00</b>	
<b>Criteria</b>		<b>Very Practical</b>	

Source: Results of data processing

**Table 8 Calculation of the implementation of popular scientific books**

Statement	Observer rating					Mean score
	O1	O2	O3	O4	O5	
1. Students read the front (table of contents, instructions and explanation of contents)	1	1	1	0	1	0,80
2. Students read the introductory information	1	1	1	1	0	0,80
3. Students read descriptions of general information	1	1	1	1	1	1,00
4. Students look at the pictures and explanations in the popular scientific book on aquatic plants in the form of a flipbook	1	1	1	1	1	1,00
5. Students pay close attention to the contents and explanations of aquatic plants	1	1	1	1	1	1,00
6. Students read facts about aquatic plants	1	1	1	1	1	1,00
7. Students use a popular scientific book on aquatic plants in the form of a flipbook when making observations	1	1	1	1	1	1,00
8. Students use a popular scientific book on aquatic plants in the form of a flipbook when conducting data analysis	1	1	1	1	1	1,00
9. Students read the glossary	0	1	1	0	0	0,40
<b>Percentage (%)</b>						<b>88,89</b>
<b>Criteria</b>						<b>Very good</b>

Source: Results of data processing

Based on the observational data on the implementation of the use of BIP as shown in Table 8 above, the percentage of 88.89% is obtained, which is included in the very good criteria. These results illustrate that the BIP that has been developed can be said to be practically used in learning. Based on research conducted by Nurlita et al. (2021) stated that the implementation of the use

of BIP with very good criteria proved that learning was going very well in accordance with the learning design contained in the semester learning plan (RPS) which had been developed to increase student learning motivation. In addition, the results obtained with very good criteria are also expected to be able to improve learning outcomes and critical thinking skills and can be used as a

reference in choosing good teaching materials so that they can be used in practical learning to achieve a predetermined learning goal of students'

critical thinking skills. The following are the results of student KBK data processing as shown in Table 9.

Table 9 Students' critical thinking skills

Critical Thinking Indicator	Mean score		N-Gain	Criteria
	Early meeting	Final meeting		
Interpretation	48,33	67,50	0,37	Medium
Assumption	67,50	80,84	0,41	Medium
Deduction	53,34	69,17	0,34	Medium
Argument Analysis	60,84	90,84	0,77	High
Inference	81,95	95,28	0,74	High
<b>Mean score</b>			<b>0,53</b>	
<b>Criteria</b>				<b>Medium</b>

Popular scientific books on aquatic plants in mangrove habitat that have been developed based on indicators to train students' thinking skills get an average score of 0.53 with moderate criteria as shown in Table 9. This means that the BIP that has been developed is able to help students with critical thinking skills even though they are not with high criteria. The KBK indicators studied include interpretation, assumption, deduction, argument analysis, and inference. Based on the data on students' critical thinking skills, it can be seen clearly that there is a change in all indicators of students' critical thinking skills, such as students' interpretation skills who get a score of 0.37, assumption skills 0.41, deduction skills 0.34, argument analysis skills 0.77 and 0.74, in which the indicators of interpretation, assumption and deduction are in the medium category, while the indicators of argument analysis and inference are in the high category.

Three indicators such as interpretation, assumption and deduction get a moderate score, this is because students are asked to think hard to determine the formulation of the problem when practicing, make their own hypotheses and collect data that is considered not easy.

Critical thinking skills are one of the thinking skills that are recognized as essential abilities needed by students in the 21st century today (Zubaidah, 2016; Hunaepi et al., 2020). In addition, critical thinking skills are thought to be a priority in research, learning, and various disciplines (Fitriani et al., 2019). Critical thinking skills are becoming a trend and the main focus of attention in learning (Lau et al., 2011). Therefore, critical thinking skills are very important to be trained in the learning process, so that students have the provision of critical thinking.

## D. Conclusion

The following is the conclusion of a popular scientific book on aquatic plants in the mangrove habitat in the form of a flipbook that has been developed.

- 1) The popular scientific book on aquatic plants in the mangrove habitat in the form of a flipbook is stated to be very practical for use in learning, especially in learning Botany.
- 2) Based on individual test data or readability test, 3 students get a percentage of 94.03 with a very practical category.
- 3) Based on student response data with 3 students in the small group test and 15 students in the large group test, the overall percentage was 86.00 with a very practical category.
- 4) Data on the implementation of the use of BIP assessed by 5 observers who observed the implementation of the use of the developed BIP obtained a percentage of 88.89 with very good criteria.
- 5) Popular scientific books developed also affect students' critical thinking skills which are marked by an n-gain score of 0.53 with moderate criteria.

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