

## The practicality of popular scientific books diversity of crab species in the Tabanio mangrove area

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Article Information	Abstract
<p><b>Keyword:</b> Practicality; Popular scientific book; Crab; Mangrove; Critical thinking</p> <p><b>Kata Kunci:</b> Kepraktisan; Buku ilmiah populer; Kepiting; Mangrof; Berpikir kritis</p> <p><b>History:</b> Received : 18/12/2021 Accepted : 31/01/2022</p>	<p>The problem that occurs in the invertebrate zoology course is that there are no innovative teaching materials related to the diversity of crab species. One of them is in the Tabanio mangrove area to explore students' critical thinking skills. This makes it necessary to develop learning resources in popular scientific books containing material with examples from the surrounding or local environment. This study aims to describe the practical of contents, expectations and actual prototypes of popular scientific books on the diversity of crab species. This research uses stages of development through formative evaluation based on Tessmer, which consists of self-evaluation, expert test, individual test, small group test, and field test and also the content practicality assessment instrument too. The results showed that a popular scientific book was declared very valid based on expert validation results with an average of 88,46%, while based on a one-to-one with an average of 92,31%. This popular scientific book is declared practical because student responses 89,29% with criteria of strongly agreeing and the implementation of popular scientific books 90,00% with outstanding criteria. Therefore, this popular scientific book can be used as an enrichment student on the ability to think critically.</p> <p><b>Abstrak</b></p> <p>Masalah yang terjadi pada mata kuliah zoologi invertebrata adalah belum adanya bahan ajar yang inovatif terkait materi keanekaragaman spesies kepiting salah satunya di kawasan mangrove Tabanio untuk menggali kemampuan berpikir kritis mahasiswa. Hal inilah yang membuat perlunya pengembangan sumber belajar berbentuk buku ilmiah populer yang memuat materi dengan contoh-contoh dari lingkungan sekitar atau lokal. Penelitian ini bertujuan untuk mendeskripsikan kepraktisan isi, harapan dan aktual prototipe buku ilmiah populer yang berjudul "Keanekaragaman Spesies Kepiting di Kawasan Mangrove Tabanio". Metode penelitian ini menggunakan tahap-tahap pengembangan melalui evaluasi formatif berdasarkan Tessmer yang terdiri dari evaluasi diri, uji pakar, uji perorangan, uji kelompok kecil dan uji lapangan serta instrumen penilaian kepraktisan isi juga mengacu pada Tessmer. Berdasarkan hasil validasi ahli, buku ilmiah populer termasuk kedalam kriteria sangat valid dengan rata-rata 88,46%, sedangkan uji perorangan diperoleh nilai sebesar 92,31%. Buku ilmiah populer ini dinyatakan praktis, karena respons mahasiswa 89,29% dengan kriteria sangat baik dan keterlaksanaan sebesar 90,00% dengan kriteria sangat baik. Oleh karena itu, buku ilmiah populer ini dapat digunakan sebagai bahan pengayaan terhadap kemampuan berpikir kritis mahasiswa.</p>

## **A. Introduction**

Invertebrate zoology is a compulsory subject for students of the Biology Education Study Program at FKIP, Lambung Mangkurat University, Banjarmasin. This course studies the notion of zoology, basic taxonomy, taxonomic hierarchy, understanding of species and nomenclature, characteristics and characteristics of classification. The invertebrate zoology course is a compulsory subject with a classroom learning model combined with practicum and field studies.

The cause of the ineffectiveness of learning invertebrate zoology courses, especially crab species diversity material, is that there is no research on teaching materials for crab species diversity in the Tabanio mangrove area. Previous research on crabs was conducted by Fauzan et al. (2020) reporting the discovery of 7 species of crabs in the Pagatan Besar mangrove ecotourism area, Tanah Laut Regency. Based on preliminary research that has been carried out in the Tabanio mangrove area, 9 species of crabs were found. Based on this, it is necessary to develop a popular scientific book on the diversity of crab species in the Tabanio mangrove area with material on the concept of crab species diversity which contains material with examples from the surrounding or local environment.

Popular scientific books (BIP) are books written in a way that is easy to understand and understand by the general public (UNSOED, 2016). Popular scientific writing uses simple, concise, solid language, the text must be according to the level of education, the ideas conveyed must be sequentially, the sentences must lead to understanding, and the sentences used must be clear and convincing (Rakedzon & Balam-Tsabari, 2016). The benefits of popular scientific books being developed are the presentation of material that is interesting, easy to understand, and relates to everyday life (Fajeriadi et al., 2019). Therefore, the development of popular scientific books is used as a solution that can be used to overcome problems in invertebrate zoology courses because it can be used inside and outside the classroom without being constrained by facilities and infrastructure.

The development of popular scientific books that lead to the implementation of knowledge and life experiences is very important, especially in understanding the surrounding environment and in improving critical thinking skills. Providing environmental insight to students in education can be done by developing environmental-based learning tools, one of which is a popular scientific book on the diversity of crab species in the Tabanio mangrove. Research on popular scientific books

has been reported by Astuti et al. (2021) these popular scientific books are valid, practical and effectively used as enrichment materials to train students' critical thinking skills.

Other research on popular scientific books has been carried out by Salsabila et al. (2021) and Rahmah et al. (2021) which state that popular scientific books are valid and practical as enrichment materials for ethnobotany courses. Other research on popular scientific books has been carried out by Lesman et al. (2021) which states that popular scientific books are effective as enrichment materials. As for other research on popular scientific books, conducted by Patmawati, (2017) stated the results of the study showed that the popular scientific books developed had a very good, interesting and suitable category for use as learning media in plant structure courses. Therefore, it is necessary to develop popular scientific books that can be used as a forum for environmental-based learning or as a source of learning based on local potential.

Local potential which is internalized in biology learning is one of the tools in presenting biological material that is suitable for everyday life (Situmorang, 2016). The use of local potential-based teaching materials in South Kalimantan has not been widely discovered or developed. Even though the use of local potential-based teaching materials really helps students to more easily understand the lecture material. Local potential-based teaching materials link learning materials with the surrounding environment. Local potential-based learning can also change the learning environment into a pleasant environment for students that allow lecturers and students to actively participate based on the local potential they already know, so that optimal learning outcomes can be obtained (Jannah et al., 2019).

Langgeng et al. (2017) stated that learning that involves local potential can hone students' awareness, thus giving rise to creativity to preserve, utilize, cultivate and develop the potential that exists in their area. Research on the development of local potential-based teaching materials has been carried out by Nurhidayati (2017) and Aswin et al. (2018). Based on these studies, a supportive learning environment can play a major role in successful learning and each region has characteristics that have the potential to be appointed as learning resources for students' critical thinking skills.

Students' critical thinking skills that are honed can help in solving a problem that will affect student achievement (Magdalena et al., 2021).

Research on critical thinking skills has been carried out by Santi et al. (2018), Magdalena et al. (2021) and Agustina et al. (2020). Based on this research, the learning process is expected to have an effect on students' critical thinking skills for invertebrate zoology courses by developing popular scientific books.

Based on the results of the initial study, researchers have found 9 species of crabs, namely *Uca perplexa*, *Uca acuta*, *Uca arcuata*, *Uca coarctata*, *Uca dussumieri*, *Uca forcipata*, *Uca tetragonon*, *Parasesarma pictum* and *Episesarma versicolor*. Several types of crabs are used to make popular scientific books so that student interactions with several types of crabs appear with the aim of enriching insight, as enrichment and knowledge and can affect critical thinking skills. Many studies on crab diversity have been carried out including by Michael et al. (2020), Natania et al. (2017) and Ngo-Massou et al. (2018).

Based on the description above, the researchers are interested in conducting research on the development of popular scientific books on the diversity of crab species in the Tabanio mangrove area which is expected to provide implications for students' critical thinking skills.

## B. Materials and Method

This research is a development research through formative evaluation of the Tessmer model. This development research begins with conducting survey research, where this research develops a learning media product based on data from survey research. The data obtained from observations of crab species were identified, described, and then made an initial product design to be developed, namely a popular scientific book entitled "Crab Species Diversity in the Tabanio Mangrove Area".

Based on the practicality assessment of popular scientific books, three parameters were tested: readability, practicability, and student response. Readability was tested one-to-one to three students. The implementation and student responses were tested through a small group consisting of 5 students and a field test consisting of 10 students. Based on the small group data, the expected implementation value or student-response expectations were obtained, while the field test obtained the actual implementation value or the actual student response.

The requirements for the examiner students are as follows; First, students have taken invertebrate zoology courses. Second, students who are involved in one-to-one are no longer involved in small groups and field tests. Third, 5 students who were involved in the small group were also

involved in the field test. Based on this, 5 out of 10 students in the field test had been involved in small groups and the other 5 had never been involved.

The readability test instrument is a content practicality questionnaire consisting of 13 indicators. Each indicator is assessed by students with a score of 1 (which means very illegible), 2 (unreadable), 3 (readable), or 4 (very legible). The average value of each indicator is calculated by the formula:

$$P = \frac{A}{B} \times 100$$

Based on the above formula, P is the value of each indicator (in percent), A is the total score obtained by each indicator, and B is the total maximum score for each indicator. Furthermore, the values of all these indicators are averaged so that the readability test value is obtained. This test value is adjusted to Table 1 below, so that the qualitative criteria for the readability test are obtained.

**Table 1 The value and criteria for the results of the readability test**

Percentage	Criteria
80,00– 100	Strongly good
60,00 - <80,00	Good
40,00 - <60,00	Currently
20,00 - <40,00	Not good
0 - <20,00	Strongly not good

(Source: Ramadhan et al., 2020)

**Table 2 Student response scores and criteria**

Percentage	Criteria
80,00 – 100	Strongly good
60,00 - < 80,00	Good
40,00 - < 60,00	Currently
20,00 - < 40,00	Not good
80,00 – 100	Strongly not good

(Source: Ramadhan et al., 2020)

The instrument for the implementation test is an implementation questionnaire sheet consisting of 9 indicators (statements), both for the implementation of expectations and actual implementation. The score for each indicator is 0 (which means it is not implemented by students) or 1 (implemented). The next calculation is like Formula 1 and Table 1 (on the readability test).

The instrument for student responses to BIP is also in the form of a questionnaire consisting of 15 indicators (statements), both for expected student responses and actual student responses.

The score for each indicator is 1 (which means strongly good), 2 (disagree), 3 (undecided), 4 (good), or 5 (strongly good). The process for determining the next student response is like Formula 1 and the criteria are as in Table 2 below.

## C. Results and Discussion

### 1. BIP Readability by Students

The practicality of the contents of the popular scientific book "Crab Species Diversity in the Tabanio Mangrove Area" was obtained based on the results of the readability test of students (3 students) as shown in figure 1 as follows.

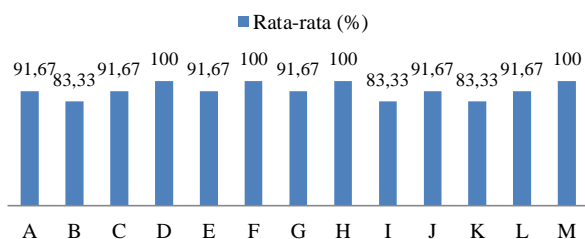


Figure 1 BIP Readability by students

Description :

- A = The text is easy to understand
- B = Image is clear or not blurry
- C = There is information on the picture
- D = The image presented is interesting
- E = The image presented is in accordance with the material
- F = Explaining a concept using illustrations of problems related to everyday life
- G = Using everyday life examples
- H = Encourage discussion with other friends
- I = Relating to biological material
- J = The material is coherent
- K = There is no sentence that has double meaning
- L = The symbol in this BIP is easy to understand
- M = The terms in this BIP are easy to understand

The student legibility test stage of the popular scientific books developed obtained the highest score of 100% while the lowest score was 83.33%. This is due to several things including, the contents of popular scientific books that have been developed are easy to understand, have clear images complete with descriptions of the images and so on. Jannah & Dwiningsih (2013) which states that a book must be able to lead readers to understand the contents of the book through media. -Special facilities, such as schematics, pictures, and illustrations so as to attract students' interest to study them.

The results of the readability test obtained an average of 92.31% in the very good category, which means that the popular scientific books can be understood and the material is easy to apply in everyday life by students. This readability test is

very important to do so that this popular scientific book that has been developed can be in accordance with the conditions of students or readers who will use it in real field learning.

Readability is a study that aims to describe the suitability of activity-based textbooks on the material. Readability relates to the ease with which the text is read (Himala, 2016). A text can be said to have high readability if the text is easy to understand, while a text is said to have low legibility if the text is difficult to understand. This is in line with Putra et al. (2021) stating that individual tests are important to do so that the teaching materials developed are in accordance with the conditions of students in the field. In addition, teaching materials according to student needs makes it easier for students to learn independently, thereby increasing interaction as a process in the learning experience.

Based on the student's legibility test, several comments and suggestions were obtained from students following the invertebrate zoology course. So that researchers feel the need to make revisions based on suggestions and comments from students on popular scientific books to further refine this product so that popular scientific books developed can meet the demands of students in order to learn more optimally with quality teaching materials, the next step is to enter the small group test stage.

### 2. Implementation of the Use of BIP

The implementation of the use of BIP "Crab Species Diversity in the Tabanio Mangrove Area" uses 5 students (expected) and 10 students (actual) S1 Biology Education ULM. Data on the implementation of the use of BIP can be seen in Figure 2.

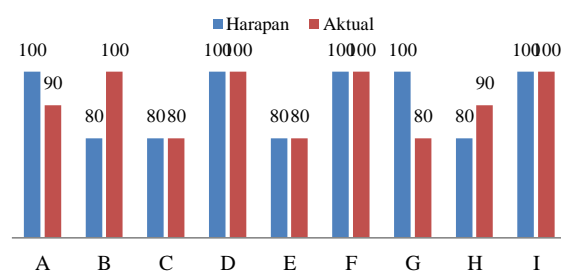


Figure 2 Implementation of the Use of BIP

Description:

- A = Read the front (table of contents, instructions and explanation of contents)
- B = Reading the preliminary information
- C = Reading descriptions of general information
- D = Observing pictures and descriptions in popular scientific books
- E = Observing the writing on the colored box
- F = Read facts about the concept of diversity
- G = Reading the glossary



H = Using popular scientific books when making observations  
I = Using popular scientific books when doing data analysis

Based on Graph 2. on the BIP implementation test "Crab Species Diversity in the Tabanio Mangrove Area" the expected and actual results obtained an average of 91.11% with very good criteria. This shows that popular scientific books developed are practical for use in learning invertebrate zoology course on students' critical thinking skills. The results of student assessments were carried out through implementation questionnaires, where the actual and expected test had the lowest score of 80.00 while the highest score was 100.00. As for one of the factors that resulted in a low percentage score, there were several students, many of whom passed the preliminary information because it was considered less important so that students paid less attention to the contents of the introduction presented in the

BIP. This is what causes some values at the implementation point to differ.

The advantages of popular scientific books that are developed are practically used based on their implementation, on certain pages in the developed popular scientific books, statements are found to explore students' critical thinking skills. This is in line with Dharmono & Riefani (2019) that the teaching materials developed must contain statements to explore students' critical thinking skills, because the presence of these statements will make students sequentially or systematically study the material part by part. presented in popular scientific books.

### 3. Student Response to BIP

Student responses to the BIP "Diversity of Crab Species in the Tabanio Mangrove Area" used 5 students (expected) and 10 students (actual) S1 Biology Education ULM. The results of student responses are presented in Table 3.

**Table 3 Student Response to BIP**

No	Statement	Practicality	
		Expectation	Actual
1	Makes me have a high willingness to follow the lesson	88,00	90,00
2	Makes me have a high willingness to make good use of study time	88,00	90,00
3	Makes it easier for me to understand the lesson	88,00	90,00
4	Interesting and not boring	88,00	90,00
5	Allows me to get rid of my misconceptions	84,00	88,00
6	If the use of popular scientific books is carried out like this, I can remember the concepts from the lesson material longer	88,00	88,00
7	Help solve problems in everyday life related to learning topics	84,00	92,00
8	Broaden my horizons	92,00	92,00
9	If invertebrate zoology learning is carried out using an inquiry model, it can improve learning achievement	92,00	92,00
10	Increase group work spirit	88,00	90,00
11	Makes my ability to interpret problems better	92,00	94,00
12	Makes my ability to assume better	92,00	92,00
13	Improve my ability to formulate problem solutions (deduction)	96,00	96,00
14	Makes my ability to argue better	80,00	88,00
15	Makes my ability to draw conclusions (inference) better	84,00	90,00
<b>Percentage (%)</b>		<b>88,27</b>	<b>90,30</b>
<b>Criteria</b>		<b>Strongly good</b>	

Based on the results of student responses that were expected and actual, the BIP "Crab Species Diversity in the Tabanio Mangrove Area" which was developed obtained results of 88.27% for expected practicality and 90.30% for actual practicality with very good criteria. So it can be concluded that the developed BIP is practically used in learning invertebrate zoology.

The expected practicality test result is 88.27% where this result is not much different from the actual practicality test result which gets a value of 90.30%. The increase in value occurs due to several things, one of which is seen from the

value of students who assess each aspect differently where some students are very easy to understand the material presented and some do still not understand the material presented. Learning using BIP according to some students is very helpful in learning this happens because students in the actual test have different views on the BIP developed, where according to them the delivery of material in BIP is clear and practical enough to be used in learning. Based on this, students on the actual and expected test strongly agree with the use of BIP which was developed as a teaching material.

These results indicate that students respond positively when using popular scientific books. The results of these student responses illustrate that popular scientific books that have been developed are practically used which are later expected to be able to explore students' critical thinking skills. This is influenced because the material presented in popular scientific books can be understood easily by students. This is in line with Dalman (2014) which states that popular scientific books should have a popular language, not be bound by standard scientific writing and display attractive images so that they can attract readers to read the contents of the material in the popular scientific book.

The positive response of students to this popular scientific book can also be created because in its development it has paid attention to various aspects, one of which is by adjusting the presentation and appearance of the material to be easily understood by readers. This is in accordance with Barnawi & Arifin (2015) which states that the presentation, appearance, and depth of material in a book including popular scientific books must be in accordance with the level of education and follow the development of science and technology.

## D. Conclusion

The results of the research on the development of the popular scientific book "Crab Species Diversity in the Tabanio Mangrove Area" obtained an average result on the student legibility test of 92.31%, the results of the BIP implementation carried out on students obtained an average result of 90.00%, while The results of student responses to BIP obtained an average result of 89.29%. This shows that the BIP developed is very practical to use to explore students' critical thinking skills in studying invertebrate zoology courses.

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