

## Effectiveness of e-book “Ethno-ecology study of Magnoliopsida in Desa Kiram” to train students’ critical thinking skills

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Article Information	Abstract
<p><b>Keyword:</b> Effectiveness; E-book; Critical thinking; Ethno-ecology; Magnoliopsida</p> <p><b>Kata Kunci:</b> Keefektifan; E-book; Berpikir kritis; Etno-ekologi; Magnoliopsida</p>	<p>Students use their smartphones for daily tasks whenever and wherever they go, and they interact with their surroundings more directly as a result. One media that carries out the advancement of technology and communication is electronic books or e-books. E-books are one kind of educational resource that needs to be created because students may easily access them only using smartphones, either offline or online. Local learning resources can be used to train critical thinking skills. This development research aims to examine the expectation and actual effectiveness of e-books to train students’ critical thinking skills. The research method used Tessmer’s formative evaluation design. The research results show that expected effectiveness got an N-gain score of 0.47 in the medium category, and actual effectiveness got an N-gain score of 0.50 in the medium category. In conclusion, it shows that the e-book “Ethno-Ecology Study of Magnoliopsida in Desa Kiram” is to be used as training material for students’ critical thinking skills.</p>
<p><b>History:</b> Received : 19/06/2023 Accepted : 07/10/2023</p>	<p><b>Abstrak</b></p> <p>Penggunaan <i>smartphone</i> tidak terlepas dari kegiatan sehari-hari kapanpun dan di manapun mahasiswa berada, serta mahasiswa lebih sering berinteraksi langsung dengan lingkungan sekitar mereka. Salah satu media yang mengimplementasikan perkembangan teknologi dan komunikasi adalah <i>E-book</i>. <i>E-book</i> menjadi media pembelajaran yang perlu dikembangkan karena mudah diakses oleh mahasiswa hanya dengan penggunaan <i>smartphone</i> secara <i>offline</i> ataupun <i>online</i>. Sumber belajar berpotensi lokal dapat digunakan dalam melatih keterampilan berpikir kritis. Penelitian pengembangan ini bertujuan untuk menguji keefektifan harapan dan aktual <i>e-book</i> dalam melatih keterampilan berpikir kritis mahasiswa. Metode penelitian menggunakan desain evaluasi formatif Tessmer. Hasil penelitian menunjukkan keefektifan harapan memperoleh skor N-gain 0,47 dengan kategori sedang, dan keefektifan aktual memperoleh skor N-gain 0,50 dengan kategori sedang. Kesimpulan hasil penelitian menunjukkan bahwa e-book “Kajian Etno-Ekologi Magnoliopsida di Desa Kiram” yang dikembangkan efektif dalam melatih keterampilan berpikir kritis mahasiswa.</p>

## A. Introduction

In the 21st century, individuals must prepare themselves to face the increasingly developing times, especially in education (Sumantri, 2019). Individuals must master critical thinking and problem-solving skills, creative and innovative thinking, communication, and collaboration (Andini & Qomariyah, 2022). Winata et al. (2019) stated that critical thinking skills are essential to be developed so that individuals can solve or overcome problems around them that are not only limited to the world of education. Critical thinking skills from Facione (1990) include interpretation, analysis, evaluation, inference, explanation, and self-regulation. Critical thinking skills can be improved by using learning media.

Learning media that can be used as a learning source that implements technological and communication developments with user interactions that are being developed today is a digital book known as an electronic book (Hartanti, 2013; Pradani & Aziza, 2019). The shift from conventional (print) book readers to e-books is one of the good uses of technology, especially in the era of rapid technological development (Novitasari, 2020). The use of smartphones and other technical devices is increasing (Gufran & Mataya, 2020), inseparable from individual activities whenever and wherever they are (Etnanta & Irhandayaningsih, 2017), and changing personal interactions with their environment (Hanika, 2015).

Teaching materials can come from the local potential of a particular region (Dharmono, 2019). Locally-based teaching materials are teaching materials that contain local material or material that is local, has ideas that are understandable, wise, full of wisdom, valuable, embedded, includes values, norms, belief systems, and ideas of the local community and related to the management of natural resources and the environment (Kun, 2013). Teaching materials from local potential positively impact or improve students' critical thinking skills (Lidi, 2019; Ridhana et al., 2021; Irhasyuarna et al., 2022).

Observation results show that many students still use printed books to help them in the field as a reference when identifying and analyzing. However, for some individuals, printed books are considered unattractive, tiring to read, and heavy to carry anywhere.

The solution to the problem of printed books can be overcome by developing interactive e-books that contain local potential material. Research on e-books with local potential material has been conducted by several researchers such as Suwarno

& Rahmatullah (2021) who developed an e-book with local wisdom of karawitan as contextual teaching material, Setyawan & Faqih (2023) who developed an e-book with local literature material of Mandiangin Island's wisdom, and Saripudin et al. (2022) who developed an e-book with West Java's local history.

One development that can potentially train students' critical thinking skills is the development of an e-book media on plant ethnobotany in Kiram Village. Kiram Village is an area rich in flora and fauna. Therefore, research needs to be conducted, such as an effort to utilize the local potential of Kiram Village as material that is loaded into a learning media. Community knowledge about the use of plants around them needs to be maintained. A unique approach is necessary so that this knowledge and utilization is widely known, namely by studying research on ethnobotany.

Previous research on efforts to improve critical thinking skills, according to Facione, has also been carried out by Fitriani et al. (2021), Ishthifaiyah et al. (2022), and Rahayu et al. (2022). The conclusions obtained from these studies, although with different media, critical thinking skills can be improved by using learning media to train critical thinking skills.

Based on the above description, researchers are encouraged to research the development of e-books on Magnoliopsida class plant ethnobotany material in Kiram Village to train students' critical thinking skills.

## B. Material and Method

This research is a developmental research with Tessmer's (1993) formative evaluation. Critical thinking skills data are measured based on Facione (1990), namely 1) interpretation, 2) analysis, 3) evaluation, 4) inference, 5) explanation, and 6) self-regulation.

The assessment of critical thinking skills is obtained through the effectiveness of test work by 5 small group test students and 20 field test students. The small group test results are expected effectiveness and the field group test results are actual effectiveness. Data will be collected twice using instruments in the form of students' worksheets and evaluation questions. The obtained test results will be analyzed descriptively using the Formula 1. The test score is adjusted to Table 1 so that the category of students' critical thinking skills can be obtained.

$$X = \frac{\text{Total score obtained}}{\text{Maximum score possible}} \times 100\% \dots \dots \text{Formula 1}$$

**Table 1 Effectiveness Category**

Percentage	Category
80,00 < x ≤ 100,00	Very Good
60,00 < x ≤ 80,00	Good
40,00 < x ≤ 60,00	Enough
20,00 < x ≤ 40,00	Less
0 < x ≤ 20,00	Less Than Once

(Source: Modified from Ramadhan et al., 2020)

The improvement of students' critical thinking skills is calculated using Formula 2 the Hake (1999) gain formula. The N-gain calculation results are adjusted to Table 2 so that the magnitude of the increase in students' critical thinking skills can be obtained.

$$g = \frac{S_{\text{posttest}} - S_{\text{pretest}}}{S_{\text{maximum}} - S_{\text{pretest}}}$$
 .....Formula 2

**Table 2 N-gain Category**

g Value	Category
g > 0,7	High
0,3 ≤ g ≤ 0,7	Medium
G < 0,3	Low

(Source: Adapted from Hake, 1999)

### C. Results and Discussion

The effectiveness of the expected e-book was obtained through small group test results. In this test, one repetition was performed to see if the e-book met expectations and could train students' critical thinking skills. The actual effectiveness of the e-book was obtained through field test results. In this test, three repetitions were performed to

observe the improvement in training students' critical thinking skills.

Based on the summary of the test results through practical guides and answering multiple-choice evaluation questions to determine expected and actual effectiveness. The expected effectiveness can be seen in Table 3, and the actual effectiveness can be seen in Table 4, Table 5, and Table 6.

Based on the expected effectiveness results in Table 3, it is known that the developed e-book obtained an average score of 62.50% for the interpretation indicator with a good category, 47.50% for the analysis indicator with enough category, 52.50% for the evaluation indicator with enough category, 63.50% for the inference indicator with a good category, 50.00% for the explanation indicator with enough category, and 60.00% for the self-regulation indicator with enough category. The average score for each indicator is in the enough categories with 56.00%.

The average results at meeting 1 showed 63.28% with a good category. Next, at meeting 2, the average results showed 69.25% with a good category. At meeting 3, the average results showed 84.53% with a very good category. These results show that the e-book can train students' critical thinking skills in meetings 2 and meeting 3 due to an increase in each meeting. This increase can be seen in Figure 1.

Improving students' critical thinking skills includes six indicators of critical thinking skills in small group tests and field tests. The results were obtained using the Gain (N-gain or g) value formula, summarized in Table 7.

**Table 3 Expected Effectiveness**

Indicator	SW	Evaluation	Average	Category
Interpretation	65,00	60,00	62,50	Good
Analysis	55,00	40,00	47,50	Enough
Evaluation	65,00	40,00	52,50	Enough
Inference	60,00	67,00	63,50	Good
Explanation	60,00	40,00	50,00	Enough
Self-regulation	60,00	60,00	60,00	Enough
<b>Amount</b>	365,00	307,00	336,00	
<b>Average</b>	60,83	51,17	56,00	<b>Enough</b>

**Table 4 Actual Effectiveness of Meeting 1**

Indicator	SW	Evaluation	Amount	Average
Interpretation	53,80	70,00	123,80	61,90
Analysis	56,30	70,00	126,30	63,15
Evaluation	52,50	70,00	122,50	61,25
Inference	56,30	61,67	117,97	58,99
Explanation	52,50	60,00	112,50	56,25
Self-regulation	56,30	100,00	156,30	78,15
<b>Amount</b>	327,70	431,67	759,37	379,69
<b>Average</b>	54,62	71,95	126,56	63,28

**Table 5 Actual Effectiveness of Meeting 2**

Indicator	SW	Evaluation	Amount	Average
Interpretation	61,30	75,00	136,30	68,15
Analysis	67,50	75,00	142,50	71,25
Evaluation	63,80	77,50	141,30	70,65
Inference	58,80	73,30	132,10	66,05
Explanation	63,80	70,00	133,80	66,90
Self-regulation	65,00	80,00	145,00	72,50
<b>Amount</b>	<b>380,20</b>	<b>450,80</b>	<b>831,00</b>	<b>415,50</b>
<b>Average</b>	<b>63,37</b>	<b>75,13</b>	<b>138,50</b>	<b>69,25</b>

**Table 6 Actual Effectiveness of Meeting 3**

Indicator	SW	Evaluation	Amount	Average
Interpretation	86,30	85,00	171,30	85,65
Analysis	80,00	80,00	160,00	80,00
Evaluation	88,80	87,50	176,30	88,15
Inference	83,80	76,67	160,47	80,24
Explanation	87,50	80,00	167,50	83,75
Self-regulation	93,80	85,00	178,80	89,40
<b>Amount</b>	<b>520,20</b>	<b>494,17</b>	<b>1014,37</b>	<b>507,19</b>
<b>Average</b>	<b>86,70</b>	<b>82,36</b>	<b>169,06</b>	<b>84,53</b>

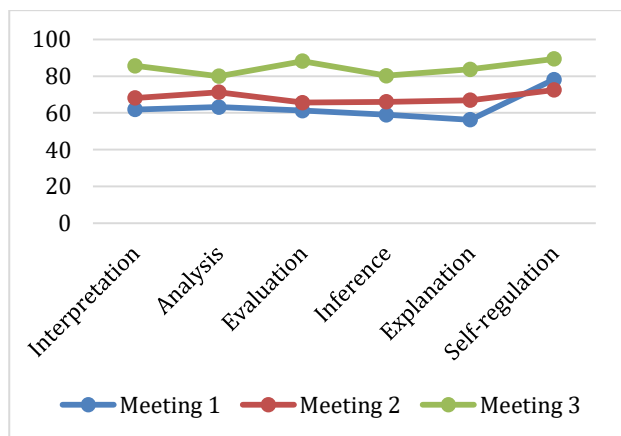


Figure 1

Graph of the increase in critical thinking skills at each meeting

**Table 7 The Results of the N-gain test for students' critical thinking skills.**

No	Indicator Critical Thinking Skills	N-gain	
		Small Group	Field Test
1	Interpretation	0,33	0,55
2	Analysis	0,32	0,30
3	Evaluation	0,58	0,60
4	Inference	0,44	0,42
5	Explanation	0,54	0,51
6	Self-regulation	0,58	0,61
<b>Average</b>		<b>0,47</b>	<b>0,50</b>
<b>Category</b>		<b>Medium</b>	<b>Medium</b>

Based on the N-gain test results in Table 7, it can be seen that the average critical thinking skills of students from expected effectiveness are 0.47 with a medium category. In the N-gain of expected effectiveness, indicators that fall into the medium category are stated to be effective in training critical thinking skills. The actual effectiveness shows an average of 0.50 with a medium category.

In the N-gain of actual effectiveness, indicators that fall into the medium category are stated to be effective in training critical thinking skills. This research is in line with Susanta et al. (2020); Ridhana et al. (2021); Hasanah et al. (2022); Wahyuni et al. (2022); Wuryani et al. (2023) which states that utilizing local potential in biology learning can improve students' critical thinking skills.

Based on the data of each indicator, the critical thinking skills in the e-book used in learning are as follows.

### 1. Interpretation

Interpretation in the learning process is presented in e-books, practical guides, and evaluation questions by asking students to formulate problems on data or discourse. The expected effectiveness obtained a score of 62.50% with a sufficient category. The actual effectiveness received a score of 76.95% with a good category.

Based on the data of each indicator, there was an increase in critical thinking skills in each subsequent meeting. The e-book used during learning effectively trains students' critical thinking skills. The increase in data at each meeting occurred because students were already trained to formulate problems. This is in line with Agnafia's (2019) research, which obtained an interpretation indicator with a score of 63.00%, which is included in the high category. Interpretation relates to an individual's ability to interpret or explain observed objects. Similarly, Wahyuni et al. (2022) research obtained an interpretation indicator score of 89.00%, which means that individuals can describe images or animations accurately according to the questions asked.

## 2. Analysis

Analysis in the learning process is presented in e-books, practical guides, and evaluation questions by asking students to analyze data that has been offered or obtained from the field. The expected effectiveness obtained a score of 47.50% with a sufficient category. The actual effectiveness received a score of 75.65% with a good category.

This means that the e-book used in the learning process experienced an increase at each meeting. This increase proves that the e-book effectively trains critical thinking skills for the analysis indicator. This aligns with Wahyuni et al. (2022) research, which obtained a score of 88.00%, meaning that individuals easily understand concepts or materials by analyzing every event.

## 3. Evaluation

Evaluation in the learning process is presented in e-books, practical guides, and evaluation questions by asking students to evaluate or assess the credibility of statements in the form of data or information. The expected effectiveness obtained a score of 52.50% with a sufficient category. The actual effectiveness received a score of 79.45% with a good category.

Improvements can be seen at each meeting from before using the e-book at meeting 1 and after using the e-book at meetings 2 and 3. This increase occurred because students were already trained to carry out evaluation indicators. The conclusion is that the e-book effectively trains students' critical thinking skills in evaluation indicators. This aligns with Agnafia's (2019) research, which obtained a score of 46.00% with a sufficient category, meaning that individuals can test and estimate logical reasoning from facts, data, descriptions, or representations. Research by Wahyuni et al. (2022) obtained a score of 85.00%, meaning that individuals can assess a statement to solve a problem.

## 4. Inference

Inference in learning is presented in e-books, practicum guides, and evaluation questions by asking students to conclude data, information, or discourse. The expected effectiveness of obtaining a score of 63.50% with a good category. The actual effectiveness received a score of 73.15% with a good category. It is known that the increase occurs at each meeting when viewed in tables and graphs.

The conclusion drawn from this increase is that e-books effectively train critical thinking skills, specifically the inference indicator. This aligns with Agnafia (2019), which obtained a score of 62.00% with a good category on the inference indicator.

This means individuals can generally identify or solve a problem to reach a conclusion. Research by Wahyuni et al. (2022) obtained a score of 89.00% with a very good category. This means that students can conclude relevant information or sources so that they can answer a problem.

## 5. Explanation

Explanation of the learning process is presented in e-books, practicum guides, and evaluation questions by restating information that students have obtained. The expected effectiveness obtained a score of 50.00% with a fair category. The actual effectiveness received a score of 75.35% with a good category.

There was an increase at each meeting from before using the e-book to utilizing the e-book in meetings 2 and 3. This increase shows that e-books effectively train students' critical thinking skills. This aligns with Wahyuni et al.'s research (2022), which obtained a score of 89.00% with a very good category, meaning that students can state arguments or opinions on an issue or discourse.

## 6. Self-regulation

Self-regulation in the learning process is presented in e-books, practicum guides, and evaluation questions by asking students to evaluate themselves during the learning process. The expected effectiveness of obtaining a score of 60.00% with a fair category. The actual effectiveness received a score of 80.95%, with a very good category.

Improvement can be seen at each meeting. This is because students are already trained to carry out evaluation indicators. The conclusion drawn from this increase is that e-books effectively train students' critical thinking skills. This aligns with Wahyuni et al.'s research, which obtained a score of 90.00% with a very good category, meaning that individuals can correct or evaluate themselves when answering a question.

Students in small group tests and field tests go through the same learning process, but the learning outcomes achieved cannot be the same. Sanjaya (2016) states that the learning process is influenced by various factors that can cause differences in learning outcomes, both internal and external factors. Fitriyansah et al. (2015) mention that the individual nature of students is individualism, where each has their own intellectual ability, talent, interest, and character in learning.

The improvement that occurs in each critical thinking skill indicator is due to the superiority of e-books that help students practice. These

advantages include (1) e-book access does not require the internet; (2) clear pictures or illustrations, making it easy for students to identify plants; (3) concise and compact information; (4) easy and fast information search, meaning that students can search for specific keywords to obtain information; (5) the font used does not tire the eyes when reading; and (6) an interactive e-book layout, so it is not boring to read; and (7) additional information in the form of videos that can be accessed by clicking. The advantages of e-books resulting from development are not without limitations in use, these limitations include (1) e-books can only be easily accessed by some smartphones; (2) using video links in e-books requires internet access.

## D. Conclusion

The results of the development research of the e-book "Study of Magnoliopsida Ethno-Ecology in Kiram Village" are stated to be effective for use in training critical thinking skills, with expected effectiveness of obtaining an N-gain score of 0.47 in the medium category and actual effectiveness getting an N-gain score of 0.50 in the medium category. Local potential has been proven several times to improve students' critical thinking skills. Utilizing local potential directly related to students' daily lives needs to be optimized. Moreover, if it is made in e-book form, students can more easily access anywhere and anytime.

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