

## THE DEVELOPMENT OF E-BOOK BASED ON MODIFIED FREE INQUIRY ON ECOLOGY TOPIC TO TRAIN CRITICAL THINKING SKILLS IN CLASS X HIGH SCHOOL STUDENTS

### *Pengembangan E-Book Berbasis Inkuiri Bebas Dimodifikasi pada Materi Ekologi untuk Melatihkan Keterampilan Berpikir Kritis Siswa Kelas X SMA*

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#### Abstract

The development of information and communication technology (ICT) which intensively provides convenience and practicality in implementing learning activities, especially during this pandemic, which requires learning to be done online. However, this does not prevent students from having critical thinking skills in the 21<sup>st</sup> century. Students' critical thinking skills can be trained using a modified free inquiry model because students are required to independently find answers to existing problems. Modified free inquiry model is the collaboration or modification of both the guided inquiry and the free inquiry model. Therefore, the use of technology is very necessary to prepare teaching materials that can train critical thinking skills. The purpose of this research was to develop e-book based on modified free inquiry on ecology topic to train critical thinking skills that are valid theoretically and empirically. This research used 4D development model (Define, Design, Develop, and Disseminate), without a dissemination stage. The e-book developed was tried out limited on 10 students of SMAN 19 Surabaya grade 10<sup>th</sup>. The validity of the e-book is determined from the validation results of experts (education experts and material experts) and biology teachers in terms of presentation, content, and language components. The practicality of the e-book is determined by student responses. The data analysis technique was carried out by descriptive quantitative. The results of the validity analysis showed an average percentage of 93.93% with a very valid category, while the results of the student responses obtained an average percentage of 98.88% with a very feasible category. Thus, it can be concluded that the modified free inquiry e-book on ecology topic to train critical thinking skills in class X high school students could be used in biology learning.

**Keyword:** E-book, modified free inquiry, Critical thinking, Ecology

#### Abstrak

Perkembangan teknologi informatika dan komunikasi (TIK) yang pesat memberikan kemudahan dan kepraktisan dalam pelaksanaan kegiatan pembelajaran, terutama di masa pandemi ini yang mengharuskan pembelajaran dilakukan secara online. Namun, hal tersebut tidak menghalangi untuk siswa memiliki keterampilan berpikir kritis di abad ke-21 ini. Keterampilan berpikir kritis siswa dapat dilatihkan dengan menggunakan model inkuiri bebas dimodifikasi karena siswa dituntut untuk menemukan jawaban secara mandiri terhadap masalah yang ada. Model inkuiri bebas dimodifikasi berasal dari model inkuiri terbimbing dan model inkuiri bebas. Oleh karena itu, sangat diperlukan pemanfaatan teknologi untuk bahan ajar di masa pandemi yang melatih keterampilan berpikir kritis. Penelitian ini bertujuan untuk menghasilkan E-book berbasis inkuiri bebas dimodifikasi pada materi ekologi untuk melatih keterampilan berpikir kritis siswa kelas X SMA yang valid secara teoretis dan empiris. Penelitian ini dilakukan menggunakan model pengembangan 4D (Define, Design, Develop, dan Disseminate), tanpa tahap disseminate. E-book yang dikembangkan diujicobakan kepada 10 siswa kelas X SMAN 19 Surabaya. Validitas e-book ditentukan dari hasil validasi ahli (yaitu ahli Pendidikan dan ahli materi) dan guru biologi yang ditinjau dari komponen penyajian, isi, dan kebahasaan. Kepraktisan e-book ditentukan dari respon siswa. Teknik analisis data dilakukan secara deskriptif

*kuantitatif. Hasil analisis validitas menunjukkan persentase rata-rata sebesar 93,93% dengan kategori sangat valid sedangkan hasil dari respon siswa memperoleh persentase rata-rata sebesar 98,88% dengan kategori sangat layak. Dengan demikian, dapat disimpulkan bahwa e-book berbasis inkuiri bebas dimodifikasi pada materi ekologi untuk melatih keterampilan berpikir kritis siswa kelas X SMA dapat digunakan dalam pembelajaran biologi.*

**Kata Kunci:** *E-book, berbasis inkuiri bebas dimodifikasi, Berpikir kritis, Ekologi*

## INTRODUCTION

The development of information and communication technology (ICT) which intensively provides convenience and practicality in implementing learning activities (Emilzoli, 2013). Convenience and practicality can help encounter the challenges of generating Human Resources who have 21st century competence. These competencies are in the form of knowledge skills and abilities in the field of technology (media and information), learning and innovation competencies, as well as life and career competencies (Partnership for 21<sup>st</sup> Century Skills, 2017).

The role of technology is directly proportional to the "21<sup>st</sup> century learning framework", which emphasizes skills and competencies that are in accordance with educational needs (Voogt, 2012). Education is a conscious effort to achieve a change made by a person both in terms of knowledge and skills (Biesta, 2011). These skills are used to the working world and citizenship in the 21<sup>st</sup> century in the form of critical thinking skills (Wargner, 2010).

Critical thinking skills include interpretation, evaluation, analysis, inference, explanation and regulation skills (Facione, 2015). In the learning process, critical thinking needs to be developed to achieve the learning objectives as stated in the Regulation of the Ministry of National Education No. 23 of 2016. These skills are very suitable to produce students, workers, and citizens who are effective and can participate in the economic development of the nation (William, et al. 2013).

In fact, students in Indonesia have low levels of critical thinking skills. This is supported by survey data from the Organization for Economic Corporation and Development (OECD) using the International Program for Student Assessment (PISA) test. According to the OECD (2016) PISA results in 2015 it is known that the critical thinking competence of students is level 5 and 6 amounting to 8% of the total respondents. 20% of all respondents have the ability to think below level 2, with a total of 42.3% of this percentage being Indonesia students. In addition, according to Permendikbud students' thinking competence is still low. So that the critical thinking skills of students in Indonesia in the 21<sup>st</sup> century need to be

improved again (Lalu, 2011).

Not only the 21<sup>st</sup> century, but the current educational emergency is also a challenge. This is because of the Coronavirus disease or what is called COVID-19. Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). WHO has designated COVID-19 as a global pandemic (Indonesian Ministry of Health, 2020). Based on UNESCO statistics (2020) states that 1,524,648,768 students are affected by the Coronavirus out of 87.1% of the total students enrolled. The total number of students who are potentially at risk from pre-primary to high school education is 577,305,660. This affects the learning process. The government policy will implement the online learning process to make teachers, students, and other staff make changes to online learning.

It is hoped that digital learning during a pandemic will keep students focused on learning and get complete material. In addition, getting teaching materials that are in accordance with the conditions and situations in the midst of a pandemic (Sukardjo, 2021). Indonesia is working to solve this problem by leveraging technology to provide online education services.

In accordance with the statement of the Ministry of Education and Culture of the Republic of Indonesia (2019) "free learning" means freedom of learning, which is to provide opportunities for students to learn as freely as possible in a calm, relaxed, and happy, without stress and pressure. So that with the existence of "free learning", it is hoped that humans can be independent and free to choose their way (Abdul, 2020). An independent attitude in life can be trained through learning activities, namely independence in finding concepts (inquiry) and carrying out intellectual activities facing problems (Schwartz, 2010).

Discovery and active investigation (investigation) are inquisitive activities that are needed in Natural Sciences, especially biology (Afnidar, 2015). Inquiry activities match the material contained in the scientific process. One of them is ecology topic using free inquiry, including orientation, formulating problems, proposing hypotheses, collecting data, testing hypotheses, and formulating hypotheses (Llewellyn, 2013).

Ecology topic contains descriptive, procedural, and applicable knowledge so that students are directed to find out and act. Therefore, students are required to think critically in order to obtain deeper concepts and understanding (Mustaji, 2012). In addition, ecology topic has many basic theories or concepts so it requires concise and complete teaching materials (Anfa, et al., 2019).

In previous research regarding the suitability of learning devices developed by biology teachers on ecology material using the 2013 curriculum, it was stated that teaching materials at SMAN 7, 8, and 19 Surabaya had the lowest score, that are 25%. In addition, the material coverage contains only general material in the form of bullet points without explanation so that it cannot be linked to student experience and the development of science and technology (Pratomo & Rachmadiarti, 2020).

In addition, previous research conducted by Amijaya (2018) stated that the existence of free inquiry-based learning was modified to train students' critical thinking skills to increase from before. The test results increased by 27.42, so it can be concluded that the modified inquiry learning model can improve students' critical thinking skills and student learning outcomes (Anam, 2016).

The sample of this research is the students of class X SMAN 19 Surabaya using interesting and practical teaching materials. The existence of technological advances provides an alternative, namely textbooks in the form of books. The e-book or the designation of this electronic book is in the form of digital data which does not only contain text and images but also video and sound (Suarez, 2013).

E-books are an alternative to answer the challenges 21<sup>st</sup> century education. But also as an alternative in emergency situations. Education. One of them is due to the presence of COVID-19 in 2020 which caused a global pandemic. So that the enactment of Work From Home (WFH) and online learning is carried out until an indefinite time (Kemendikbud, 2020). In E-book learning, it is very effective to use, as evidenced by student learning outcomes which are 58.49% in feasible category and 35.85% in very feasible category (Alwan, 2018).

Based on the description above, to train students' critical thinking skills in the 21<sup>st</sup> century and in this pandemic condition, a good procedure is needed in the form of developing an electronic book (E-book) based on modified free inquiry. The purpose of this research was to help students discover concepts by actively investigating during the study of ecology topic according to modified free inquiry characteristics.

## METHODS

This research was a development research using the 4D

model (Define, Design, Develop, and Disseminate), without a disseminated stage. This research was conducted from October 2020 to January 2021. The development stage was carried out at the Learning Lab Center for Mathematics and Natural Sciences Studies and the IsDB Building, Surabaya State University.

The defining stage uses several analyzes including curriculum analysis, students, student analysis, task analysis, concept analysis, and analysis of learning objectives. Curriculum analysis, namely curriculum analysis 2013 with Basic Competencies 3.1 and 4.1.

Then student analysis which includes analysis of assignments and concepts. The task analysis was obtained by identifying the task on the ecology topic that the students would do on the modified free inquiry-based e-book that was developed. Concept analysis is obtained by identifying the main concepts included in the book, systematically arranging and detailing the relevant concepts. Then analyze the learning objectives that will be achieved during learning.

The design stage is the stage of making the initial product design of an e-book based on modified free inquiry. This stage consists of compiling test criteria, selecting media, selecting formats, and product design.

The development stage is carried out to produce a development product, namely an e-book based on modified free inquiry that is valid based on the revised results of education experts, material experts, and high school biology teachers which are then tried out limited on 10 students of SMAN 19 Surabaya grade 10<sup>th</sup>.

The instrument in this study used a validation instrument for theoretical feasibility on an e-book based on modified free inquiry. Validation sheets are developed based on criteria for good teaching materials, namely the suitability of presentation, content, and language (BNSP, 2014). The validation instrument has two aspects, namely the e-book aspect based on free-modified inquiry and the critical thinking aspect which includes interpretation, analysis, inference, evaluation, explanation, and self-regulation.

Data validity results were analyzed descriptively quantitatively, by selecting scores 1-4 using a Likert scale. E-book based on free modified inquiry is said to be valid if it gets a valid percentage  $\geq 70\%$ .

The percentage average score of the criteria can be calculated by the following formula:

$$p \text{ validation}(\%) = \frac{\text{Average score of each aspects}}{\text{Average maximum score}} \times 100\%$$

Based on the results of the percentage of validation, then interpreted using the validity criteria (Table 1).



**Table 1.** Validity Criteria

Percentage (%)	Criteria
25-39.9	Not feasible
40-54.9	Less feasible
55-69.9	Fair
70-84.9	Feasible
85-100	Very feasible

(Riduwan, 2013)

Furthermore, using the student response instrument using a questionnaire for empirical feasibility on a modified free inquiry-based e-book. The student response questionnaire consisted of two criteria, namely the e-book criteria based on modified free inquiry and critical thinking criteria. Then calculated by the percentage based on the category "Yes" and "No" using the Guttman scale. E-book based on modified free inquiry is said to be feasible if it gets at least a feasible category with a percentage of  $\geq 61\%$ .

The percentage of student responses can be calculated using the following formula:

$$P \text{ Response } (\%) = \frac{\text{number of students answered "yes"}}{\text{the number of students}} \times 100\%$$

Based on these results, the percentage of student responses was interpreted using feasible criteria (Table 2)

**Table 2.** criteria of practicality

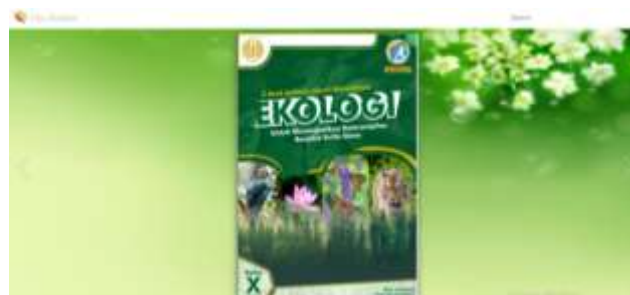
Percentage (%)	Criteria
00.0-20.0	Not feasible
21.0-40.0	Less feasible
41.0-60.0	Fair
61.0-80.0	Feasible
81.0-100.0	Very feasible

(Riduwan, 2013)

## RESULT AND DISCUSSION

The results of this research are in the form of e-book development products, namely e-books based on modified free inquiry on ecology topic to train critical thinking skills in class X high school students that are theoretically and empirically feasible. E-books have sub topic in the form of ecosystem components, interactions between ecosystem components, the food pyramid in the ecosystem, ecosystem productivity, and ecosystem dynamics. The e-book is produced according to the design.

It is in the form of digital media with a flipbookpresentation (flipbook) which consists of three parts, namely the introduction, contents, and closure.



**Picture 1.** E-book cover

The e-book is designed with paper size B5 and uses Book antique font size 12.



**Picture 2.** Present of content and features in the e-book

There is text content, images, videos and hyperlinks that are linked to the internet.











**Picture 3.** Present of text, image, video and hyperlink

In addition, the e-book has several features that support modified free inquiry learning and train critical thinking skills. The main feature of this e-book is BIO-Lab (Table 2). BIO-Lab is a feature that supports active investigation activities and there are indicators of critical thinking to train students' critical thinking skills.

Other complementary features are BIO-Think, BIO-Net, BIO-Quiz, BIO-Reflection, BIO-Info, BIO-Graph, and REVIEW (Table 2).

**Table 3.** Features in the E-book

No.	Features	Description
1.		To hone students' critical thinking contain indicators of interpretation and analysis
2.		Student activities in the form of independent activities and contains indicators of critical self-regulation thinking
3.		Provides an external link that can be accessed by students to get information and knowledge from the internet
4.		Questions in the form of quizzes in each section. The questions are designed in the form of puzzles and contain indicators of students' critical thinking interpretation
5.		Reflective activities in daily activities or in the surroundings of the material being discussed

6.		Multiple choice questions and essay to train students' understanding of these sections
7.		Information about scientists or experts in the field of ecology
8.		The latest information related to the material to increase knowledge

E-book based on modified free inquiry on the developed ecology topic has several characteristics (Table 4)

**Table 4.** Characteristics based on e-book modified free inquiry on ecology topic to train critical thinking skills

No.	Aspect	Characteristics
1	Characte ristics	<ul style="list-style-type: none"> <li>a. In the form of digital data</li> <li>b. Format .exe file</li> <li>c. Had a transition effect moving from one page to another</li> <li>d. There were hyperlinks as shortcut to certain content</li> <li>e. Had external link that provides a link to the intended internet location</li> <li>f. There were photos and videos that support the concept</li> </ul>
2	Use of e- books	<ul style="list-style-type: none"> <li>a. Can be used via laptops and smartphones</li> <li>b. Can be accessed via the linkk bellow <a href="https://online.flipbuilder.com/jczr/pguc/">https://online.flipbuilder.com/jczr/pguc/</a></li> </ul>
3.	Content	a. Contains material based on KD

- 3.1 and 4.1 curriculum 2013
- b. Contains material on components, interactions between components, the food pyramid, productivity, and the dynamics of the ecosystem community.
  - c. There were several features that train students' critical thinking skills

This developed e-book based on modified free inquiry on ecology topic can be used via a computer or smartphone. This is in accordance with Andina's (2011) statement that e-books are digital books that can be read via computers or other digital devices. The e-book can be accessed online and offline. Online use facilitated by the existence of hyperlinks can help students to find some information and news as supporting concepts in solving problems. This is in accordance with the needs of inquiry, namely finding your own answers and analyzing the information that has been obtained (Hasanah, et al., 2019). Supported by Wijaya's (2016) statement that hyperlinks can train digital literacy which can be used to gather information.

E-book based on modified free inquiry on ecology topic to train students' critical thinking skills had been validated by three validators, namely education expert lecturers, material expert lecturers and biology teachers reviewed based on presentation, content and language components. The following is a recapitulation of the results of e-book validation based on modified free inquiry on ecology material to train students' critical thinking skills (Table 5).

**Table 5.** Recapitulation of e-book validation results

No.	Aspect	Average score	Percentage (%)	Interpretation
<b>PRESENTATION FEASIBILITY</b>				
1	Presentati on quality	3,93	98,13%	Very valid
2	Layout E-book page	3,50	87,50%	Very valid
3	Suitability of the type of letters used in the e-book	3,60	90,00%	Very valid
4	Color quality	3,75	93,75%	Very valid
5	Supporting qualities	3,43	85,63%	Very valid
Average of presentation		3,64	91,00%	Very valid

feasibility				
<b>CONTENT FEASIBILITY</b>				
6	Extent and truth concept	3,91	97,81%	Very valid
7	E-book systematic s	3,94	98,43%	Very valid
8	Aspects of critical thinking	3,80	95,00%	Very valid
9	Achieveme nt of critical thinking on each feature	3,78	94,42%	Very valid
Average of content feasibility		3,78	94,38%	Very valid
<b>LANGUAGE FEASIBILITY</b>				
10	Use of Language	3,80	95,00%	Very valid
11	Language structure	3,85	96,25%	Very valid
12	Use of terms	3,75	93,75%	Very valid
13	The ability to motivate and find concepts	3,70	92,50%	Very valid
Average of language feasibility		3,78	94,38%	Very valid
Average of all feasibility		3,75	93,93%	Very valid

Based on the e-book results table based on modified free inquiry on ecology topic, validation was carried out by 3 validators, namely education expert lecturers, material expert lecturers, and biology teachers showing an overall average score of 93.93% with a very valid category (Riduwan, 2013 ). Validation is measured by the feasibility of presentation, content feasibility, and language feasibility.

The feasibility of presentation includes 5 aspects of assessment and gets a score of 91.00%. From this percentage, it shows that the quality of the presentation, the layout of the e-book pages, the suitability of the type of font used, the quality of the colors, and the quality of the support is very valid. E-books can be used via computers, laptops, and smartphones, which is an advantage in terms of accessibility (Hidayat, 2017).



There were hyperlinks and external links in the e-books that support students to find their own concepts from some of the readings provided, so that learning is more active, lively and enjoyable. Learning environment with inquiry, namely by finding your own concept, encourages students to be curious and students are free to discuss so that learning is not tense and fun (Rosnita, 2011).

The content feasibility component received a percentage value of 96.42%. Content feasibility consists of four aspects of evaluation, namely the extent and truth of the concept, e-book systematics, critical thinking aspects, and critical thinking attainment in each feature. In the aspect of the breadth and correctness of the concept, it gets a score off 97.81%, which means that the concept in the e-book is in accordance with the basic competencies and learning indicators.

The presentation of the material is also supported by several features. The feature in the e-book is BIO-Lab, which contains group or individual practicum. BIO-Think feature which contains questions to train students' critical thinking skills. Thinking activities through questions in the BIO-Think feature make students carry out the process of solving problems or using ideas (Kuswana, 2011).

In e-book systematics, the highest percentage of content feasibility was 98.43%. This shows that the arrangement of e-books in an systematic and neat manner can facilitate student understanding and train students to think coherently (BNSP, 2014). Presentation of books must be arranged in sequence starting with learning objectives, coherent material, attractive book designs, exercises, and evaluation questions (Kurniasih, 2014).

In the aspect of achieving critical thinking skills, the features have different results between features according to the indicators of students' critical thinking skills. This feature is able to train critical thinking skills. Students are able to involve the ability to interpret various information and make informed decisions so that these skills can be used to solve problems in life (Kereluik, et al., 2013).

The language feasibility component gets a very valid category with a percentage of 94.38%. The language feasibility component consists of four aspects of assessment, namely the use of language, language structure, use of terms, the ability to motivate and be interactive. The feasibility aspect of language is assessed from communicative, straightforward, informative, according to PUEBI, does not add multiple meanings, accuracy of language structures and use of terms. The use of terms that have multiple meanings or ambiguous data causes misunderstanding or misunderstanding and affects students' perceptions (Sugiyono, 2012).

The practicality of e-book based on modified free

inquiry on ecology topic to train students' critical thinking skills in terms of student responses. Retrieval of student response data consisted of 10 students grade 10<sup>th</sup> using student response questionnaires. The student response questionnaire consisted of two criteria, namely the e-book criteria based on modified free inquiry and critical thinking criteria

**Table 6.** Recapitulation of student response results.

No.	Criterion assessed	positive response (%)	Category
<b>E-book criteria based on modified free inquiry</b>			
1	Attractive cover design	100%	Very feasible
2	The e-book is easy to operate	100%	Very feasible
3	The contents of the e-book are in accordance with the learning objectives	100%	Very feasible
4	e-books can increase knowledge about ecology topic	100%	Very feasible
5	Presentation of information in an interesting e-book	100%	Very feasible
6	An attractive e-book layout	100%	Very feasible
7	The color combination of the full	100%	Very feasible
8	The writing in the e-book based on modified free inquiry can be read clearly	80%	Feasible
9	The font style and size in the e-book can be distinguished	100%	Very feasible
10	The images presented are clear and illustrate the content	100%	Very feasible
11	The video that is presented is clearly visible and illustrates the	100%	Very feasible

	content of the material			
12	E-book data flipped easily	90%	Very feasible	
13	Table of contents content can be clicked to a specific page	100%	Very feasible	
14	External links that connect directly to the internet	100%	Very feasible	
15	The language used is easy to understand	100%	Very feasible	
16	Using of bilingual (English) in this e-book is required	100%	Very feasible	
Average		98,12%		
Category		Very feasible		
<b>Criticak thinking criteria</b>				
17	The e-book contains interpretation activities (categorize, interpret phenomena)	100%	Very feasible	
18	The e-book contains analytical activities (connecting a process)	100%	Very feasible	
19	The e-book contains inference activities (linking data, making conclusion)	100%	Very feasible	
20	The e-book contains evaluation activities (express an opinion)	100%	Very feasible	
21	The e-book contains explanatory activities (explaining concepts)	100%	Very feasible	
22	The e-book	100%	Very	

	contains self-regulation activities (correcting self-understanding)		feasible
23	The features in the e-book can make it easier to understand the material	100%	Very feasible
24	E-books can build knowledge independently	100%	Very feasible
25	The features in the e-book have guided students and directed students to find concepts	100%	Very feasible
Overall average		100%	Very feasible
category		98,88%	Very feasible

Based on Table 6 shows that students give positive responses to learning activities using e-books based on modified free inquiry on ecology topic to train students' critical thinking skills, which can be identified by interpreting the "yes" answers given by students to several criteria and got an average score of 98.88%.

In the criteria of e-book based on modified free inquiry, it got a positive response of 98.12% with the very feasible category. This shows that the appearance of the e-book is attractive. Supported by the e-book cover, e-book layout, and presentation of interesting information, students are not bored to read. Attractive teaching materials can foster stimulation for students in the learning process so as to increase student interest and motivation to learn new things in the learning material to be delivered (Teni, 2018).

The e-book developed has content that is in accordance with the learning objectives. Videos and pictures in the e-book that support the concept make it easier for students to understand the material. However, there are several criteria that have received negative responses to the e-book used. Some of the criteria that get a negative response are the writing in the e-book which is small so it is not clear if it does not zoom so that it needs improvement in the writing font settings.

On the criterion of critical thinking, it gets a 100% positive response with the very decent category. This shows that the e-book has activities that train critical thinking skills in the form of interpretation, analysis, inference, evaluation,



explanation, and self-regulation.

Interpretation is the ability to understand, express the meaning of an experience, situation, data, judgment of conventions, beliefs, rules, procedures, or criteria. Analysis is the ability to identify the intended allegations and rumors from among statements, questions, concepts, descriptions, or other forms of representation aimed at expressing beliefs, judgments, experiences, information or opinions. Evaluation is the ability to logically assess the credibility of statements, perceptions, experiences, situations, judgments based on arguments. Inference is identifying and securing the elements necessary to draw logical conclusions. Explanation is the ability to coherently convince the results of a reasoning. Self-regulation is the ability to monitor a person's cognitive activities and the results are concluded (Facione, 2015).

Critical thinking is one of the key competencies that must be possessed to solve the problems needed for individuals to face present and future challenges (Saido, et al., 2015).

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#### CLOSING

##### Conclusion

E-book based on modified Free inquiry on ecology topic to train the critical thinking skills of class X students theoretically and empirically feasible. The theoretical feasibility based on the study of expert lecturers of education, lecturers of material experts, and biology teachers shows an average percentage of 93.93% with very valid categories. Empirical feasibility based on student responses obtained an average percentage of 98.98% with a very feasible category.

##### Suggestion

Based on the result of research on the development of e-book based on modified free inquiry on ecology topic in class X high school students, the suggestions given are as follows:

1. it is necessary to conduct research on the application of e-book based on modified free inquiry on ecology topic to determine its effectiveness in learning by paying attention to the allocation of time and teaching materials.
2. The time allocation given needs to be considered so

that it is efficiently used for e-book work, especially when doing practicum.

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