

THE PRACTICALITY OF PROBLEM SOLVING E-BOOK IN PLANT GROWTH AND DEVELOPMENT MATERIAL TO TRAIN CRITICAL THINKING SKILLS

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Abstract

The ability to solve problems or problem-solving steps include identify, define, enumerate, analyze, list, and self-correct. Each of them can be used to practice critical thinking skills. The purpose of this research was to produce a practical problem-solving based e-book on plant growth and development topic in order to facilitate students' critical thinking skills. This study used a 4-D development model namely Define, Design, Develop, and Disseminate, but the disseminate stage was not conducted. Limited trials were conducted on 20 students of class XII IPA 2 of SMA Negeri 16 Surabaya. The research instruments were readability sheet, test sheet, questionnaire sheet for student and teacher responses. The data were analyzed quantitatively descriptively. The practicality of the e-book was reviewed from the results of the readability test, critical thinking skills, student and teacher responses. The results of the study indicated that the readability test results categorized as level 12 which was suitable for use by XII grade high school students. E-Book was stated to be very good for practicing critical thinking skills of 85,26% completeness indicators. Student and teacher responses showed a very positive results with a score of 97.4% and 100% respectively.

Keywords: practicality of e-books, critical thinking skills, plant growth and development.

INTRODUCTION

The 2013 curriculum emphasizes that the learning process must be students centered and contextual. Students act as active agents in the learning process by building their knowledge based on the experience. The implementation of 2013 curriculum carried out with the use of innovative learning models and methods to train and integrate 4C (critical thinking, collaborative, creativity, and communication), HOTS, literacy, and character education (Kemendikbud, 2016). Therefore, the implementation of 2013 curriculum that uses a scientific approach can make students have the ability to solving any problem.

Problem solving is a process of solving a problem that requires knowledge (Dostal, 2015). In line with the opinion of Demirel et al (2015) who asserts that problem solving is a cognitive process which is used to solve a problem based on logical steps in finding a solution. Thus, problem solving can train students' critical thinking skills in solving problems properly.

Critical thinking is a strategy in taking a decision that has reason based on the existence of facts

and it is also related with the concept (Facione, 2013). Critical thinking is an important ability for students in facing challenges often arises both in nowadays and in the future as their responsibility and obligation (Tsui, 1999). Critical thinking is used in a variety of situations and opportunities to solve problems. Thus, it is regarded as the important point to be taught to students, so that, they are able to think critically for solving problems. Critical thinking includes of critical thinking ability and critical thinking disposition (Ennis, 2011). Critical thinking ability leads to cognitive aspects while critical thinking disposition leads to affective aspects.

Several studies have shown that critical thinking skills possessed by students in the field of biology are still low (Masita et al, 2016). As for one of the subjects in Biology that demands critical thinking skills, that is, the topic of the growth and development of plant. This topic is closely related to daily life and it is implicative in which it contains many explanations of phenomena that occur in organism, so that many students experience difficulties with the concept of this topic (Laili & Yuliani 2019). This research is supported by the results of daily tests of 16 high school students in Surabaya, where there

are still many students gain score is in below of the standard set by the school, thus, the students need real learning through observation, forecasting physical symptoms, applying concepts, planning research and being able to communicate scientifically to improve problem-solving skills and higher-order thinking skills for learning outcomes (Puspitasari, 2014). As a result of the low critical thinking of students, it is due to the lack of learning process that exercises on critical thinking skills, the limited learning tools and media are used whereas the learning is able to practice those skills (Wahyuni, 2015).

One of the learning media can support learning is by choosing innovative textbooks and being able to practice students' critical thinking skills. One of the innovative and environmentally friendly (paperless) teaching materials is electronic books (e-books). E-books are books in digital form which are interactive, so then, it is more effective and efficient to be accessed (Ali, 2014). E-books are a transition from traditional book to electronic book in which it has digital features in the form of audio, video, and animation (Moody, 2010). One of the e-books has been used and declared theologically feasible with the category is very valid and it can be ready to be implemented in learning process is an e-book based on the problem solving of the growth and development of plant material developed by Ayulistiana & Yuliani (2020). E-Book is equipped with image, video, hyperlink, flip animation, material, evaluation, and discussion features in which it can train the critical thinking skills. Regarding with this phenomenon, this research aimed to release the E-book based on problem solving about the material of plant growth and development that was feasible in terms of the practicality of the e-book based on the results of the readability test, critical thinking skills, student responses, and teacher responses.

METHODS

This research was a research development using the 4D model, namely, define, design, develop and disseminate. However, the disseminate stage was not conducted. This research was conducted at the Department of Biology FMIPA Unesa and SMA Negeri 16 Surabaya, starting in February 2020 – March 2020. The goal of this research was to develop teaching materials in the form of problem solving-based e-books on the topic of practical plant growth and development based on the results of the readability test, critical thinking skills, student, and teacher responses. The trial was limited to 20 students and a biology teacher of SMA Negeri 16 Surabaya. The data collection methods used were the readability test, the test critical thinking, the

questionnaire of student and teacher response. Then, the research instruments used were readability test sheets, critical thinking skills assessment sheets, student and teacher response questionnaire sheets.

The e-book readability test, carried out by the method selecting the pieces of discourse in each sub-chapter of the e-book that contained of 100 words without noticing the length of the discourse. Further, 100 words were selected and calculated by the number of sentences and the number of syllables. The number of syllables was multiplied by 0.6. After the data obtained, it interpreted on the Fry graph (Sari, 2017).

The students' critical thinking skills were known from the provision of tests at the end of learning. From this test, the completeness of critical thinking indicators could be calculated including interpretation, inference, analysis, explanation, evaluation, and self-regulation. According to Riduwan (2013) the completeness of each indicator was obtained by calculation as follows.

$$P (\%) = \frac{\text{number of complete students}}{\text{number of all samples}} \times 100\%$$

Further, the percentage of each indicator was interpreted as follows.

Table 1. The Criteria for Interpretation of Indicator Completeness

Percentage Interval (%)	Category
0-24	Ineffective
25-49	Less Effective
50-74	Quite Effective
75-100	Effective

(Riduwan, 2013)

Furthermore, a limited trial was carried out on the e-book to determine the response of students and teachers. Student and teacher responses were measured using the Guttman scale with the following range of 0-1. Score 0 was answer no and score 1 was answer yes (Riduwan, 2013).

The results of student and teacher responses were obtained and it analyzed using a formula

$$P (\%) = \frac{\sum \text{students who answered yes}}{\sum \text{all student samples}} \times 100\%$$

The result of percentage, then interpreted in accordance with the criteria table of response interpretation to obtain the level of practicality of e-books (Riduwan, 2013)

Table 2. Interpretation Criteria for Student and Teacher Responses

Score Percentage (%)	Category
0-48	Extremely not practical
48-61	Not practical
62-74	Quite practical

Score Percentage (%)	Category
75-87	Practical
88-100	Extremely practical

(Riduwan, 2013)

RESULTS AND DISCUSSION

The readability test of e-book was used to determine the level of difficulty or ease of the reading text to be understood by users based on the level of readability presented in (Table 3).

Table 3. Recapitulation Readability Level of E-Book

Part	Page	Σ Sentences	Σ Syllables	Level
Definiton of plant development and growth	4	9	$283 \times 0,6 = 169,8$	12
Germination	7	5	$273 \times 0,6 = 163,8$	12
Secondary growth	15	6	$278 \times 0,6 = 166,8$	12
Internal Factor	21	11	$280 \times 0,6 = 168$	12
External Factor (nutrition and water)	27	6	$281 \times 0,6 = 168,6$	12

Regarding with the readability test results, in the five sample readings were categorized at level 12 indicates that the reading was suitable to be used for readers of class XII SMA / MA. Readability is a level of ease and difficulty in a reading According to the reader. Therefore, readability must be adjusted to the level of user ability (Widyaningsih & Zuchdi, 2015). If the learning activities of books that is used by students have a level of readability above their class, they will experience difficulties in obtaining information (Himala, 2016). Readability test on e-book had been developed in every sub-chapter of the e-book section. The sample was expected to be able to represent the entire contents of the e-book that was developed. Based on Table 3, it can be seen that the five samples used were suitable for readers who were at level 12. It proved that the compatibility with the target of e-book user was class XII. Thus, it could be said that e-books had been developed were practical in terms of readability.

Critical thinking abilities of students could be known through the completeness of the indicators of critical thinking skills which include interpretation, explanation, analysis, inference, evaluation, and self-regulation.

Table 4. The Result of Completeness Indicator

No.	Indicators	Achievement (%)	Category
1.	Interpretation	98,0	Excellent
2.	Explanation	78,75	Good
3.	Analysis	93,34	Excellent
4.	Inference	73,75	Good
5.	Evaluation	67,50	Quite Good
6.	Self Regulation	100	Excellent
Average Scores		85,26	Excellent

Based on the completeness of the indicators of critical thinking skills in Table 4, it can be seen that there were two indicators have not reached completeness yet, although categorized as very good by thr score of 85.26%. The ability to think critically is the skill to create strategies in making decisions that have reasons based on the facts that exist and the contextual aspects of the problems faced and related concepts (Facione, 2013).

The six critical thinking indicators were trained by the indicators. There were two indicators gained the score below 75, namely, the inference indicator gain a percentage of 73.75% with a good category. Inference is the ability to make guessing on the results of data analysis and make conclusions (Facione, 2013). On this inference indicator, the students were less able to understand the presentation of a given problem. Thus, some of them answer inccorectly. The other indicator, evaluation, was the indicators that gained the lowest percentage of achievement, which was 67.50% with quite good category. Evaluation is the ability to assess the credibility of sentences or statements or images in which it is asserted into the conclusion (Facione, 2013). Students were demanded to be able to judge by giving arguments that were in accordance with the concept. However, the students are still not very good in expressing opinions in accordance with the concept (Hidayanti et al, 2016).

The response of 16 students and Biology teachers of SMAN Surabaya toward the e-book based on problem solving on the topic of the growth and development of plant could be determined based on the distribution of student and teacher questionnaires presented in **Table 5** below.

Table 5. Recapitulation Results of Student and Teacher Responses

No	Statements	(%)	Category
1	The presentation of e-book problem solving based growth and development of plant is interesting.	99,25	Very Practical
2	The material in the e-book problem solving based growth and development of plant is complete and motivating to learn.	96,65	Very Practical
3	Language and term in problem solving based growth and development of plant is are easy to understand.	98,75	Very Practical
Average		98,22	Very Practical

Dealing with the results of student and teacher responses in Table 5, the students and teachers shew positive responses to e-books had been developed with an average of 98,22% that was categorized as a very practical category. Student responses become one of the practical indicators of the e-book which had been developed. E-book based on problem solving about the growth and development of plant was developed interestingly, thus, it could motivate students to learn.

The teacher as a respondent to measure practicality shew that e-books was very practical to be used in learning process because it was easy to deliver material to be understood for its supporting content such as pictures and videos. The involvement of teacher in responding to the need of e-books must be done, because teachers are important agents who play a role in selecting and determining appropriate teaching materials, so that, the demands of competence can be achieved by students optimally (Kantun, 2015). The teaching material chosen by the teacher was according to the demands of the curriculum. Thus, it could be used as the guidance of the learning process to find out the substance which should be known by the student.

CONCLUSION

Based on the analysis and discussion, it could be concluded that the problem solving based e-book on the topic of plant growth and development to practice the critical thinking skills was expressed in practical terms. From the results of the readability test shows the e-book is at level 12 suitable to be used by students of class XII high school. Completeness indicators of critical thinking skills of 85.26% are with very good categories. Positive responses of students and teachers with percentages are respectively of 97.4% and 100%.

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