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## Practicality and Effectiveness of E-Book Based LCDS to Foster Students' Critical Thinking Skills

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# Practicality and Effectiveness of E-Book Based LCDS to Foster Students' Critical Thinking Skills

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**Abstract.** This study aims to analyze the practicality and effectiveness of E-book based LCDS to foster students' critical thinking skills, especially on static fluid material. The research method used a quasi-experiment with pretest-posttest with control group design. The sampling technique used purposive sampling technique, which was the high school students in Bandar Lampung. The instruments which were used are the e-book implementation observation sheet, students' responses to e-books, and critical thinking skills test questions. Data analysis techniques use descriptive analysis with percentage, N-gain analysis. The results showed that LCDS-based e-books: 1) practical, as indicated by a) average score of e-book implementation in each learning activity, namely 84.43% with very high criteria and b) positive response of students (84.45%) to the e-book. 2) effective, as shown by significant differences in students' critical thinking skills between the experimental class and the control class. The critical thinking skills of students in the experimental class who were taught using E-book based LCDS are better than the control class.

## 1. Introduction

Education is one of the most important things that must be considered by a country [1]. This caused education has a role in the needs of human resources in the country. The progress of the times that exist needs to be considered by various sectors, especially the education sector. One of them is the development of technology. The existence of these technological developments should not be wasted, especially for the education sector. Technology can be used as a medium of learning in conveying learning by teachers [2]. Later by utilizing technology as a medium of learning, learning is no longer teacher-centered but is centered on students using an instruction media approach [3]. Learning by using technology such as computers and even laptops will be felt attractive because they are able to display images, sounds, videos, and animations, so can attract students' attention [4]. The use of this technology is very suitable to use in physics learning because physics requires an innovation that is able to attract students' attention.

Based on the results of preliminary research of high school students in Bandar Lampung, 94.44% of students stated that the learning media in the class was not integrated with technology such as computers or laptops. Whereas 52.78% of students stated that learning activities would be interesting if applied using learning media which is integrated with technology such as computers or laptops. Not only



interesting, but the use of technology in learning has a positive impact on students. That the use of technology in learning can improve problem-solving skills for students as observed by [5].

Physics is one subject that requires a thorough understanding of concepts, one of them is the static fluid material. One way to generate students' conceptual understanding is to train students to find their own concepts so that students will be more easy to understand the concept if they find concepts in their own way [6]. Therefore, learning media of technology utilization will guide the concept discovery process for students. Of course in the process involves the ability to think from students. One form of students' thinking ability is the ability to think critically. If learning is teacher-centered, students are not automatically trained to develop their critical thinking skills and only passively accept knowledge from the teacher. A well-planned learning environment can help students to develop their thinking skills in learning [7].

Critical thinking is a reflective, critical, and creative reasoning activity that is oriented to an intellectual process that involves conceptualizing, application, analysis, assessing information collected (synthesis) or generated through observation, experience, reflection, communication as a basis for a belief (belief) and action [8]. High Order Thinking is the best learning technique in a real-world context and by varying student scenarios can use newly acquired skills [9]. Critical thinking is indispensable for each individual to pass all the problems in life. Critical thinking has a goal as expressed by [10], namely to test an opinion or idea, include in this process is to do considerations or thoughts based on the opinions raised. Critical thinking includes considering activities based on known opinions, the purpose of critical thinking is to achieve a deep understanding [11].

Every student needs to be equipped with the ability to think critically as capital to criticize various symptoms and problems that arise around them [12]. To be able to include students' critical thinking skills in each learning, it is necessary to practice consistently so that students are accustomed to using their critical thinking skills. If a student's critical thinking skills are trained then it will be easy for them to solve problems effectively. Based on previous research, several learning strategies/ methods/models can be used to build students' critical thinking skills, including using interactive multimedia or simulation [13]. Critical thinking skills can also be grown with a set of questions that refer to indicators of critical thinking skills [14].

The purpose of this study was to apply the learning using learning media like e-book based LCDS to describe the improvement of students' critical thinking skills in terms of practicality and effectiveness of e-books in learning the static fluid material.

## **2. Experimental Method**

### *2.1 Research Design*

This study used a quasi-experiment with product trial design using pretest-posttest with control group design. Assessment of product practicality is demonstrated by the use of E-book based LCDS and the results of teacher and student responses toward learning using E-book based LCDS in the form of qualitative data. While product effectiveness is shown by the results of the pretest and posttest of students' critical thinking skills in the form of quantitative data.

### *2.2 Research Sample*

The sampling technique used purposive sampling technique, the sample was chosen based on the researchers' considerations. The research sample involved 2 physics teachers and 62 students of 11 grade. This study was conducted in two classes, namely the experimental class which used E-book based LCDS and the control class in learning only used conventional printed books.

### *2.3 Research Instruments*

The research instrument which was used to verify the practicality of the product consists of two types, namely the product implementation observation sheet and the student response/response sheet to the

product. Implementation observation sheets are used to determine the level of learning effectiveness using E-book based LCDS consisting of 17 items with very good, good, good enough, and bad answers. Whereas for the student response/response sheet is used to determine the response of students after using E-book based LCDS in learning consisting of 33 items. For the instrument to verify the effectiveness of the product uses a critical-flow skill test consisting of 10 essay questions adopted from [15]. Before all instruments are used, the instrument has been validated by experts and declared valid.

#### 2.4 Data Analysis

The result of data analysis practicality of E-book based LCDS is carried out descriptively. The practicality of E-book based LCDS was reviewed from implementation in student learning and student's response to e-books. The implementation of the e-book is determined by calculating the average score from each aspect, then change the average score to a value with a predetermined criterion. The reference for changing scores to a fifth scale according to [16] can be seen in Table 1 below.

**Table 1** Conversion score assessment statement of practical quality score.

The level achievement	Qualification
81 – 100%	Very good
61 – 80%	Good
41 – 60%	Good enough
21 – 40%	Less good
0 – 20%	Not good

Data analysis to determine the improvement of critical thinking skills on the use of e-books based on LCDS using an average analysis of N-Gain scores. The n-gain analysis is used to determine the effectiveness of E-book based LCDS. Interpretation criteria for N-gain proposed by [17], where if the gain is > 0.7, it is included in the high category, more than 0.3 and less than the same as 0.7 medium categories, and less than equal to 0.3 entered in the low category.

### 3. Result and discussion

#### 3.1 Practicality of E-book based LCDS

The practicality of E-book based LCDS is seen through the implementation of e-books in learning and student's responses to e-books. Implementation aspects are reviewed during observations by observers during the learning process using E-book based LCDS. Observation activities carried out by covering several aspects, namely aspects of e-book implementation for independent learning, social system implementation, and the implementation of the reaction principle. The results of observations of E-book based LCDS implementation can be seen in Table 2.

**Table 2** Results of e-book based LCDS observations.

Aspect of observations	Observer		Percentage
	I	II	
Implementation of e-books for self-learning	32.00	31.00	87.50
Implementation of the social system	16.00	17.00	82.50
Implementation of reaction principle	10.00	10.00	83.33
	Average		84.43

Table 2 shows the results of E-book based LCDS implementation observations with an average score of 84.4% which was included in the very high category. This means that the E-book based LCDS which

was developed has a role in independent learning by students, social systems, and good reaction principles. Learning activities using E-book based LCDS facilitate students in understanding the static fluid material by linking each concept to events in the surrounding environment.

Implementation in the aspect of self-learning shows that E-book based LCDS which were used can help students to be able to learn independently even though there is still a teacher's role as a facilitator. The percentage obtained in this aspect is 87.5% which is in the very high category.

The implementation of the social system in learning can be seen from the interaction between teachers and students, students and students as well as students and e-books. This interaction occurs when the teacher guides students in group discussions to solve problems in e-books. While the interaction between students and students is seen in the activities between students in each group. In addition, the interaction between students and e-books occurs when students access e-books during learning. Through the interaction of these three aspects, students tend to be more active in learning. There is a positive interaction between students, teachers, and learning resources, so it affects the implementation of a social system that gets a very high percentage [18]. The percentage which obtained in this aspect is 82.5% which is in the very high category. Student responses to E-book based LCDS can be seen in Table 3.

**Table 3** The results of student response on e-book based LCDS

No.	Observation aspect	Average	Percentage
1	Effective	3.36	84
2	Interactive	3.39	84.75
3	Efficient	3.36	84
4	Convenience	3.36	84
5	<i>Self Efficacy</i>	3.42	85.5
Average		3.378	84.45

Table 3 shows the results of student's responses to E-book based LCDS in each aspect. This aspect consists of aspects of effective, interactive, efficient, convenience, and self-efficacy. Each aspect that was asked on the student response sheet obtained an average percentage was in the very high category, and for the overall average aspect was 84.45% which showed that the students' response to E-book based LCDS was very high. As previously stated by [19] that students will be positive about interactive learning and they feel confident during learning because students are given freedom and responsibility during learning using interactive multimedia.

The existence of interesting learning by using multimedia will motivate students to interact with the learning environment rather than with traditional learning print materials, so this allows that the understanding of students will increase with the use of new technologies [20].

Students' responses that are classified as very high are also supported because the content in e-books displays interactive videos in several sub-chapters. Interactive videos that provide freedom in accessing learning content that is individually controlled by individuals can lead to better learning outcomes and higher student satisfaction [21].

### 3.2 Effectiveness of E-book based LCDS

The results of the analysis of students' critical thinking skills in the experimental class and control class based on pretest and posttest can be seen in Table 4.

**Table 4** N-Gain results and different tests of student critical thinking skills

Class	Pretest	Posttest	N-gain	Criteria	Sig.
Control	54,58	66,53	0.37	medium	0,000
Exsperiment	44,27	89,27	0.81	high	

Based on Table 4, the experimental class using E-book based LCDS gained higher critical thinking skills than the control class using conventional modules. The results of the Mann-Whitney analysis showed that there were significant differences in mean (Sig. 0.000) between the experimental class and the control class. The higher N-Gain score of critical thinking skills in the experimental class indicated that E-book based LCDS which was used in learning had high effectiveness in fostering students' critical thinking skills in the static fluid material. Learning by using E-book based LCDS that have been prepared in accordance with indicators of critical thinking skills are able to help students to grow their critical thinking skills after passing through each stage of learning. Besides being based on the use of instructional media, the teacher's role is also important in fostering students' critical thinking skills where the teacher acts as a facilitator in the classroom. Although students are not completely allowed to access learning media, the teacher continues to accompany the course of the learning process in accordance with the direction of developing students' critical thinking skills on e-books. The greater the teacher creates opportunities for the emergence of an interaction between students, the more opportunities for students to think critically in passing learning in the classroom [22]. The existence of learning media in the form of E-book based LCDS provides an opportunity for students to interact with both the teacher, other students, and the learning media themselves in the process.

In a previous study revealed that web-based electronic modules in the Mobile version format can improve student learning performance as indicated by a normalized gain score of 0.32 and in the medium category [23]. This supports existing product development in the form of E-book based LCDS that are integrated with laptops.

Students' understanding will also last a long time in each student's memory when taught by involving his critical thinking skills. Learning information obtained through high-level thinking processes will be remembered longer and clearer than information processed through memorization/memorization and the higher the HOTS level of students, the better their performance in physics [24]. This supports the N-Gain data obtained that students' understanding in the experimental class is higher than the control class. This opinion is supported by previous research that students in the experimental group who use their critical thinking skills in learning are more successful than students in the control group without applying skills critical thinking [25].

The results of the analysis of each indicator of students' critical thinking skills in the experimental class and control class can be seen in Table 5.

**Table 5** Results of analysis of critical thinking skills indicators

Critical thinking's indicators	N-gain	
	Exsperiment	Control
Applying the concept	0,84	0,32
Identifying / formulating criteria to consider possible answers	0,88	0,12
Give a simple explanation	0,76	0,38
Interpret the question	0,83	0,26
Ability to give reasons	0,76	0,39

Based on Table 5, the results of the analysis of students' critical thinking skills in the first aspect are applying the concept with the experimental class N-Gain value of 0.84 and the control class of 0.32. The difference in increasing the value of N-Gain indicates that students have been able to apply the concept in answering the problems presented. The ability to apply the concept is trained by learning the material in electronic books. Electronic books provide pictures and videos that can guide students to provide explanations based on the concept of static fluid material. The existence of pictures and videos makes it easy for students to apply concepts that have been received before. This is supported by the research of [26] which states that still, images can explain a concept concretely and realistically. Found that the use of moving image media/animation improved student learning outcomes [27].

The next aspect is the aspect of identifying/formulating criteria to consider possible answers with N-Gain values in the experimental class of 0.88 and in the control class of 0.12. An increase in the value of N-Gain occurs because, in learning, students are given the opportunity to explore learning by investigating simulations provided in electronic books. Students are asked to study the simulation given and then asked to provide the results of their investigation. Through animation, students can become easier to understand the subject matter [28-29]. This is in accordance with the opinion of [30] which states that integrating video clips in multimedia can improve students' perceptions of important information and motivation for learning.

The next critical thinking aspect is to give a simple explanation with the value of N-Gain in the experimental class of 0.76 and in the control class of 0.38. The increase in the value of N-Gain in this aspect occurs because of an increase in students' understanding of the material after learning an electronic book that presents animations, pictures, and simple explanations in the form of text, formulas, and sample problems. The existence of these facilities provided by electronic books makes students better understand the static fluid material in particular. But the indicator provides a simple explanation to place it on the lowest result among other indicators. This is in accordance with [31] study that indicators provide simple explanations to get the lowest percentage compared to other indicators which are 76.0% and 75.0%, but even though the lowest is still in the good category.

The next aspect is to interpret the question with the N-Gain value in the experimental class of 0.83 and in the control class of 0.26. This increase in the value of N-Gain occurs indicating that students can induce and consider the results of the induction of exposure to material in electronic books. Later on the test questions of critical thinking skills, students presented problems related to the presentation of the material in the electronic book.

The last aspect is the ability to give reasons, obtained the value of N-Gain in the experimental class is 0.76 and in the control class is 0.39. An increase in the value of N-Gain indicates that students have been able to provide a reason for the problem presented. In electronic books presented images and animations and then students are asked the reason for the phenomenon presented. The skills to provide reasons for the learning process indicate that students have critical thinking. In accordance with the research of [32] which states that in addition to mastering the concept, the goal of physics learning is to develop thinking skills. The ability to think can be in the form of giving reasons and drawing conclusions that are smart about the problems at hand.

#### 4. Conclusion

Based on the description in the discussion it can be concluded that E-book based LCDS on the static fluid material, 1) practically seen from the results of E-book based LCDS implementation in learning, excellent teacher response, and positive student response to the use of E-book based LCDS. 2) effective seen from the difference in the results of the students' critical thinking skills test between the experimental class and the control class. Critical thinking skills of students in the experimental class who are taught using E-book based LCDS are better than the control

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