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IMPROVING HIGH SCHOOL STUDENT'S CRITICAL THINKING ABILITY THROUGH DIGITAL MEDIA ASSISTED BY LECTORA INSPIRE ON LIGHTWAVE MATERIAL

Iwan Permana Suwarna[1], Raldy Aditya[1], Uwes Anis Chaeruman[2], Moch. Sukardjo[2]

[1] Syarif Hidayatullah State Islamic University of Jakarta, Indonesia
[2] State University of Jakarta, Indonesia
*Corresponding author: iwan.permana.suwarna@uinjkt.ac.id or
iwanpermanasuwarna_9902921003@mhs.unj.ac.id

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Abstrak

Penelitian ini dilatarbelakangi oleh rendahnya kemampuan berpikir kritis siswa Sekolah Menengah Atas (SMA) dibeberapa daerah di Indonesia. Penelitian ini bertujuan untuk mengetahui pengaruh penerapan media digital berbantuan Lectora Inspire terhadap kemampuan berpikir kritis siswa kelas XI pada gelombang cahaya. Penelitian dilakukan di SMA N 25 Jakarta Pusat selama empat minggu pada bulan April 2021 dengan sampel 72 siswa. Sampel dipilih dengan *purposive sampling*, yang terdiri dari 36 siswa kelas XI IPA 1 (kelompok kontrol) dan 36 siswa kelas II IPA (kelompok eksperimen). Metode penelitian yang digunakan adalah eksperimen semu dengan desain penelitian *nonequivalent control groups*. Hasil uji hipotesis posttest melalui uji Mann Whitney U dengan taraf signifikansi 5% diperoleh nilai sig. Nilai (2-ekor) 0,001. Hipotesis nol ditolak (pengaruh media Lectora Inspire terhadap keterampilan berpikir kritis siswa). Kemampuan Berpikir Kritis Siswa Kelompok Eksperimen meningkat lebih tinggi (n-gain 0,5 kategori sedang) dibandingkan kelompok kontrol (N-gain 0,06 kategori rendah). Respon siswa sangat baik (83%) terhadap pelajaran ini. Penerapan media pembelajaran Lectora Inspire berpengaruh pada peningkatan kemampuan berpikir kritis siswa.
Kata Kunci: Lectora Inspire, berpikir kritis, pembelajaran fisika, gelombang cahaya.

Abstract

This research is motivated by the critical thinking abilities of senior high school (SMA) students who are low in several regions in Indonesia. This study aims to determine the effect of the application of digital media assisted by Lectora Inspire on the critical thinking skills of eleven-grade students on light waves. The study was conducted at SMA N 25 Central Jakarta for four weeks in April 2021 with a sample of 72 students. The sample was selected with purposive sampling, which consisted of 36 students in the first eleventh-grade science class (control group) and 36 students in the second science class (experimental group). The research method used is quasi-experiment with the research design of nonequivalent control groups. The results of the posttest hypothesis test through the Mann Whitney U test with a significance level of 5% were obtained by sig. Value (2-tailed) 0.001. The zero hypothesis is rejected (Lectora Inspire the influence of media on student critical thinking skills). Critical Thinking Ability Students Experimental Group increased higher (n-gain 0.5 middle category) than the control group (N-gain 0.06 low categories). Students respond very well (83%) to this lesson. Application of Lectora Inspire learning media has an impact on improving student critical thinking skills.
Keywords: Lectora Inspire, critical thinking, learning physics, lightwaves.

INTRODUCTION

Critical thinking skills are one of the skills that students must have. Critical thinking is one of the 21st-century skills [1]. Education in the 4.0 revolution era requires students to have one of the 21st century through increasing strength and competence, namely 4C (critical

thinking, creative, communication, collaboration), problem solving, innovation, and learning literacy [2]. Critical thinking skills are very important for students to have. Critical thinking is a systematic process that provides opportunities for students to formulate and evaluate their own beliefs and opinions [3]. Ideally, necessary individuals have 12 critical thinking skills grouped into five aspects of critical thinking skills, such as 1) basic clarification, 2) basic support, 3) inference, 4) continued clarification, and 5) strategies and tactics [4]. The problem in this study is the ability to think critically in students. Low student critical thinking skills are caused by the learning media used by the teacher, especially in physics lessons that have not been able to improve students' critical thinking skills. It is hoped that future researchers will resolve the critical thinking skills of students using more interactive media.

Critical thinking skills in high school in Indonesia are still low. The low critical thinking ability of students is influenced by learning strategies designed by teachers, namely the way the learning tends to be watched and students only receive information such as listening and memorizing what the teacher says [5]. This is in line with Asysyifa et al. [3]. The common ability of students in critical thinking can be seen from the results of the analysis using the theory of the Response (view of Item / IRT response), with a partial credit model approach (PCM). The analysis results of one secondary school in Indonesia show that only 1.67% of students have critical thinking skills, 60% of students have moderate critical thinking skills, and 3.33% of students have low critical thinking skills. Students' ability to think critically is lacking in the situation and conditions of the less interactive learning environment. These factors lead to less interactive media and cannot provide visualization in the physics learning process. Changes are needed in the media used for the learning process.

Other areas in Indonesia also have almost the same problems, such as Bandung and South Sumatra. The results showed that the critical thinking ability of secondary school students in Bandung scored 31 of the maximum value of 100 [6]. The critical thinking skills of SMA 4 students in South Sumatera are in a low category, with a percentage of achievement of 35.91% [7]. Students have difficulty in reasoning level indicators. On the other hand, the quality of learning facilities is still limited. The limitations of interactive media to support the learning process cause less interactive learning. The media used by the teacher has not been able to use text, sound, video, animation in one unit. The media used for the current learning process also cannot visualize abstract material and do not have relatively easy and flexible storage.

Students need to improve their critical thinking skills. Students who have low critical thinking skills will have short-term memories when learning. Students will easily memorize but will quickly forget the material that has been studied and is invalid [8]. Another impact if this is left unchecked is on the quality of human resources. Indonesia cannot produce graduates who can be under postgraduate competency standards and challenges of 21st-century skills. The low student achievement in the light wave material must be addressed immediately. If this is ignored, the physics exam results in common light wave material will continue in the next school year. Learning media in schools are less interactive and cannot visualize abstract physics material. If this is permitted, students will have difficulty studying abstract physics material. students who have critical thinking skills will be able to identify a problem, analyze information to solve problems, and draw appropriate conclusions for solving the problem [9].

The solution to overcome the difficulties of students in mastering critical thinking skills is to use interactive media. The most appropriate interactive media for this problem is Lectora Inspire. Lectora Inspire is software that can be used to create interactive learning media [10]. Lectora Inspire can create animation with explicit attractive templates designed for learning, text, sound, and video in one unit. Lectora also can visualize abstract material and difficult to understand for students. Lectora Inspire having other supporting applications such as Camtasia, Snagit, and Flypaper, making more interesting animations and videos [8]. Lectora Inspire is a medium that has relatively easy and flexible storage.

Research on the influence of Lectora Inspire on critical thinking skills was previously conducted by Lutfiana [11], The Effect of Lectora Inspire on Students' Critical Thinking Skills on Diffraction and Mechanical Wave Interference Materials for Class XI SMA. The

results of the study show that there is an increase in critical thinking when applied with Lectora Inspire media compared to learning without using Lectora Inspire media. From this research, researchers want to conduct research using Lectora Inspire media but by involving 12 sub-indicators of critical thinking on light wave material which includes reflection of light, refraction of light, diffraction of light, interference of light, and polarization of light. The researcher chose the light wave material because there are some concepts that are abstract and difficult for students to understand if they don't see the phenomenon directly.

The difference in the features of Lectora Inspire used by this research with previous research is that in this study, games were made that matched the critical thinking indicators. Lectora Inspire obtaining valid, practical, and effective results in improving student learning outcomes [12]. Therefore, Lectora Inspire can be used to help students to master their critical thinking skills.

RESEARCH METHOD

This study uses a quantitative approach with quasi-experimental methods (quasi-experiment). This method determines the effect of treatment given in the population or sample in other samples in controlled conditions. This method has a control group but cannot fully control external variables that affect experiments [13]. The treatment given in this study is Lectora Inspire media to determine differences in student critical thinking skills.

The design of this study uses the method of the Nonequivalent control group. In this design, two groups (experimental groups and control groups) were not randomly selected [13]. At the initial stage, researchers provide a pretest to determine the level of student critical thinking skills while at the same time determining the control group and experimental group. An experimental group is a group given treatment, namely learning to use Lectora Inspire media. Conversely, the control group is a group that is not treated or using conventional media commonly used by teachers at school. After treatment was completed, the two groups were given a posttest to determine the extent to which students' critical thinking skills in both groups were given different treatments. The population is a generalization area consisting of objects/subjects with specific quality and characteristics determined by researchers to be studied and then concluded [13]. The population in this study totaled 72 students of class XI MIPA SMA N 25 Jakarta even in the semester of the academic year 2020/2021, which was divided into two classes.

The sample is a part, or representative of the population studied [14]. The sampling technique used by researchers is a non-probability sampling technique. The non-probability sampling technique is a sampling technique that does not provide the same opportunity or opportunity for each member of the population chosen as a sample [13]. The non-probability sampling technique selected by the researcher was purposive sampling. Purposive sampling is a technique with a specific consideration Experiments and XI MIPA 1 as a control group at SMA N 25 Jakarta.

The instruments used in this study are critical thinking test instruments and non-test instruments, namely student response questionnaires. The results of the construct validity test for the test instrument can be seen in Table 1 below.

Table 1. Construct Validity Test Results of Test Instruments

Statistic	Question Item
number of questions	12
number of students	72
number of questions tested	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
valid question number	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
percentage of valid questions	100%

Table 2. Result Content Validity Test Result

Aspect	CVI Score	Category
Content	0,96	Highly Valid
Construct	0,92	Highly Valid
Language	0,86	Highly Valid

Table 2 shows two aspects that are considered in the very appropriate category, so it can be concluded that this test instrument is

valid and feasible to use in the study. Reliability is the determination of test results when given to the same subject [15]. To find out this determination, look at similar results. In this study, tests only use tests and are tested once. The reliability results for test instruments can be seen in Table 3 below.

Table 3. Conclusion Question Reliability

Statistic	Question Reliability
r_{11}	0,98
Conclusion	Very High

A good question is a question that is not too easy or too difficult [15]. A good question has a balanced difficulty level. A problem that is too easy doesn't stimulate students to increase their efforts to solve it. On the other hand, the too difficult questions will cause students to be desperate and have no enthusiasm to try again because they are out of reach [15]. The results of the test level of the test instrument can be seen in Table 4.

Table 4. Difficulty Level Test Results

Question Criteria	Question Item	
	Number of items	Percentage
Easy	0	0%
Medium	8	66,67%
Difficult	4	33,33%
Total	12	100%

RESULT AND DISCUSSION

The data described is the result of research on the influence of digital media assisted by Lectora Inspire students' critical thinking skills on Lightwave material. The effects of the data obtained include data from the pretest, posttest, and n-gain from the control and experimental groups and the results of student responses from the experimental groups.

1.1. Students' Initial Critical Thinking Ability Before Treatment

Pretest results of critical thinking students obtained from the experimental group and control before being given treatment in this study were presented in Figure 1.

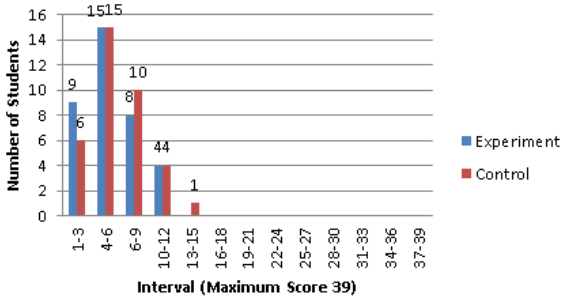


Figure 1. The frequency distribution diagram of the pretest control group and experimental group.

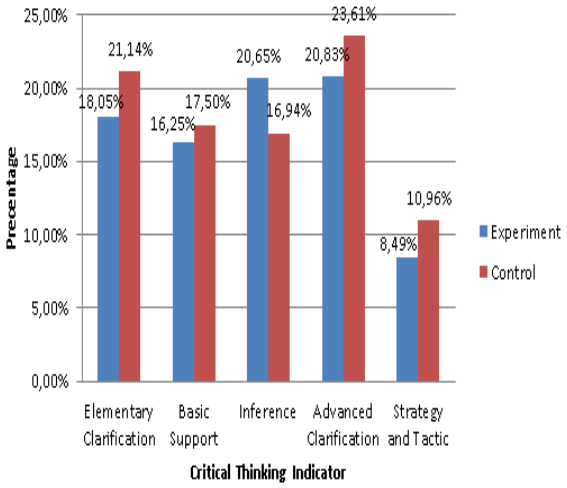
Figure 1 shows the distribution of student scores at each control interval and experimental group if the maximum score is 39 points. Based on the results can be concluded that there is no significant difference between the scores of the student experimental group and the control group. So, both groups have the same initial capabilities.

Critical thinking skills in this study are based on, according to Ennis, critical thinking indicators include basic clarification, important support, inference, sophisticated clarification, strategies and tactics. Student critical thinking skills can be seen in Table 5.

Table 5. Pretest results indicator of critical thinking control groups and experimental group.

Critical Thinking Indicator	Maximum Score	*Pretest*			
		Control		Experiment	
		$\bar{X}$	%	$\bar{X}$	%
Elementary Clarification	7	0,47	21,14	0,40	18,05
Basic Support	7	0,58	17,50	0,54	16,25
Inference	9	0,50	16,94	0,52	20,65
Advanced Clarification	4	0,47	23,61	0,81	20,83
Strategy and Tactic	12	0,64	10,96	0,50	8,49
Total	**39**	**2,66**	**90,15**	**2,77**	**84,27**
Mean		**0,53**	**18,03**	**0,55**	**16,85**

The recapitulation of the percentage of students' pretest results in the experimental group and the control group on each critical thinking indicator can be seen in Figure 2.



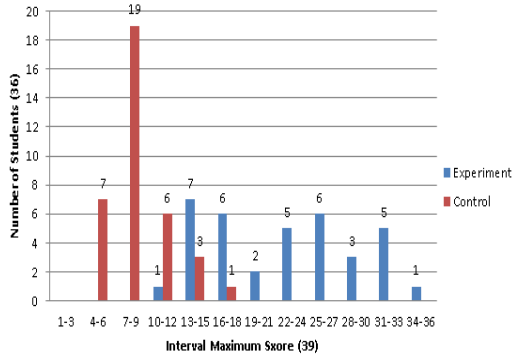


Figure 3. Frequency distribution diagram of the results of the posttest experimental group and control group students.

Figure 3. Shows the distribution of student scores at each experimental group interval and the control group if the maximum score is 39 points. The average posttest score from both groups can be seen more clearly in Figure 4.

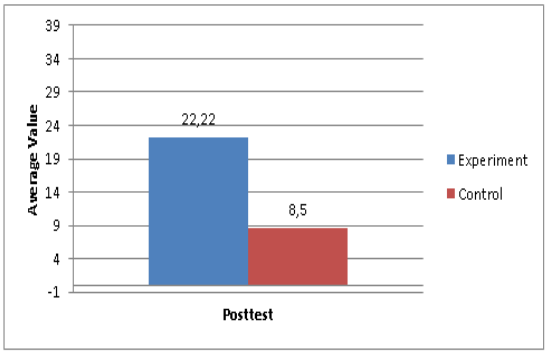


Figure 4. The posttest average score diagram of the experimental group and the control group.

Based on Figure 4, it can be concluded that there are significant differences between student scores of experimental groups and

Figure 2 Pretest group student diagrams Results of experiments and control groups on each indicator of critical thinking.

The results of the two groups based on graphics show that the critical thinking of the two groups has the same initial ability because there is no significant difference in the score.

1.2. The final ability of critical thinking students after treatment

The posttest results obtained from the experimental group and control after being given treatment in this study were presented in Figure 3.
control groups. So, both groups have different end capabilities. According to Ennis, the ability to think critically in this study is based on indicators of critical thinking, including basic clarification, important support, inference, sophisticated clarification, strategies, and tactics. Student critical thinking skills after being given treatment can be seen in Table 6.

Table 6. Posttest Results Indicator Control Group Think Critical and Experimental Groups

Critical Thinking Indicator	Maximum Score	*Posttest*			
		Control		Experiment	
		$\bar{X}$	%	$\bar{X}$	%
Elementary Clarification	7	0,73	32,56	1,56	69,60
Basic Support	7	0,68	21,11	1,82	52,64
Inference	9	0,54	19,35	1,63	59,54
Advanced Clarification	4	0,61	30,56	1,36	68,06
Strategy and Tactic	12	1,06	18,09	3,14	52,07
Total	39	3,62	121,67	9,51	301,91
Mean		0,72	24,33	1,90	60,38

The recapitulation of the percentage of posttest results of the experimental group and control group students on each critical thinking indicator can be seen in Figure 5.

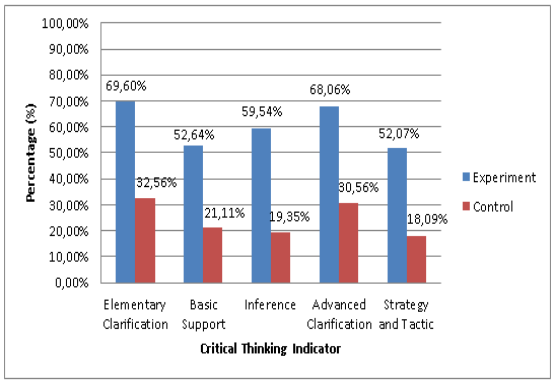


Figure 5. The diagram of the pretest results of the experimental group students and the control group on each indicator of critical thinking.

Figure 5 shows the diagram of recapitulation of the results of the posttest experimental group and the control group students in each indicator of critical thinking. These results indicate that the highest percentage of indicators of critical thinking students found in the experimental group in each indicator. The posttest results of the two groups based on the graph have a significant difference, so that it can be concluded that the end of the final critical thinking of the two different groups.

1.3. Improve students' critical thinking skills in the experimental class and control class

The increase in critical thinking of students in both groups was obtained from the average n-gain value. The n-gain results of the control group and the experimental group can be seen in Table 7 below.

Table 7. The average n-gain results of the experimental group and the control group

Group	*N-gain*	Category
Experiment	0,50	Medium
Control	0,06	Low

Based on the value of n-gain, it can be compared that the increase in critical thinking skills of students who receive treatment with Lectora Inspire learning media higher than students who receive treatment with conventional media. Recapitulation of differences between pretest and posttest in the experimental group and the control group can be seen in Figure 6.

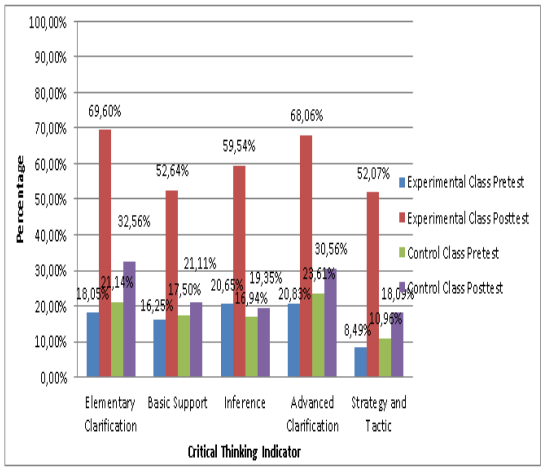


Figure 6. Different diagrams in the average score of the Pretest and posttest students in the experimental group and the control group.

Table 8 results of the average n-gain indicators of critical thinking students in the experimental group and control group

Critical Thinking Indicator	*N-gain*			
	Experimental Class	Category	Control Class	Category
Elementary Clarification	0,69	Medium	0,17	Low
Basic Support	0,43	Medium	0,03	Low
Inference	0,45	Medium	0,01	Low
Advanced Clarification	0,56	Medium	0,07	Low
Strategy and Tactic	0,48	Medium	0,07	Low

These results indicate that the increase in critical thinking of students in the experimental group is higher (significantly) than the control group.

1.4. The results of the student response questionnaire analysis

Data on student response questionnaires obtained from experimental groups about the use of Lectora Inspire media is processed based on indicators. Data is obtained in a percentage, which is then interpreted in the student interest report in the Media Lectora Inspire. This can be seen in Table 9.

Table 9. Student Responses to the Use of Lectora Inspire Learning Media

Questionnaire Indicator	Percentage of Student Response	Interpretation
Student responses to the use of Lectora inspire media.	82,22%	Very Good
Students' critical thinking skills after using Lectora inspire.	82,78%	Very Good
The advantages of learning with the use of Lectora inspire.	84,44%	Very Good
Average	**83,15%**	**Very Good**

1.5. Discussion Result of the Research

The final results of student critical thinking skills in each indicator differ between experimental groups and controls. The basic clarification indicator in the control group was 69.60%, and the experimental group was 32.56%. The ability of high experimental students on the basic clarification indicator is because students can provide a direct explanation, formulate problems in the case of interference patterns, mention similarities and differences in the pattern of diffraction lattice, and write questions in cases of polarizing light. The main support indicator in the experimental group was 52.64%, and the control group was 21.11%. High ability Student experimental students on fundamental support indicators are because students can provide arguments related to the problem of multiple-gap disorders and prove the wavelength of light based on observed interference patterns. The inference indicator in the experimental group was 59.54%, and the control group was 19.35%. The high ability of experimental student students on inference indicators is because students can conclude, consider the results of induction and reduction, and make decisions in cases of polarization, diffraction, and multiple interference patterns. The other clarification indicator in the experimental group was 68.06%, and the control group was 30.56%. The high ability of the experimental group on an advanced clarification indicator is because students can provide further explanation by defining constructive interference and destructive interference and can also identify the existing assumptions regarding light polarization. The strategy and tactics indicators in the experimental group were 52.07%, and the experimental group was 18.09%. The high ability of experimental group students about tactic strategies and indicators is because students can determine the right action for the problem of light polarization and use a logical strategy to determine what must be done with the problem of light phenomena. While the posttest score is low in the control group caused by conventional media users cannot improve student critical thinking skills.

Based on the data obtained, the indicators of critical thinking in the experimental group experienced a significant increase in every indicator. Increased every indicator seen from n-gain. The experimental group experienced a 69% increase in basic clarification indicators, while the control group was only 17%. This is because the image displayed can stimulate students to ask questions related to light lights, find the equation and difference between light diffraction and light disorders, and identify conclusions associated with the phenomenon of polarization of light. Meanwhile, important support indicators in the experimental group experienced the lowest increase compared to other indicators at 43% and a control group of 3%. The simulation shown does not stimulate students to make important notes about light diffraction phenomena at the first meeting. Then at the second meeting, the theory presented with media Lectora is not enough for students to adjust it to several other sources related to the phenomenon of light interference. Then at the third meeting, the simulation did not encourage students to find strong evidence related to the polarization of light. These factors cause n-gain experimental students to be the main support indicators lower than other indicators. Inference indicators in the experimental group increased 45%, and the control group only increased by 1%. The other clarification indicator in the experimental group increased by 56%, and the control group only increased by 7%. The strategy and indicators of the experimental group tactics increased by 48%, and the control group only increased by 7%. Increasing every indicator in the experimental class is higher than in the control class. In the experimental group, students become more interactive using Lectora Inspire media than the control group, which only uses conventional media. These results are also related to student responses to the treatment provided. Based on the interviews, the control group students felt that the media used did not

stimulate students to interact. Students of the control group tend to only pay attention to the questions given and look for answers by visiting other websites with unknown validity. At the same time, experimental group students are very enthusiastic when learning, and students feel very focused when studying. Students of the experimental group are always vigilant every time a question is asked and discussed to solve the given problems. Students in the control group feel that visualization is displayed through conventional media less than stimuli and has no significant effect. Meanwhile, with the help of Lectora, the experimental group provided visualization that made students interested and focused on what they learned. This is in line with the research conducted by Lutfiana, Susilawati, and Wawan, which states that the influence of digital media is assisted by Lectora Inspire and has improved students' creative thinking skills in every aspect of the moderate category [11] The increase in students' critical thinking is seen when students give the right response to a given statement or problem. This is in accordance with Ennis' statement which defines that critical thinking is a correct assessment of a statement[16].

Statistical hypothesis tests conclude that there are differences in the final score of the average critical thinking of students in the experimental and control group. Based on the increase (n-gain) in each indicator of critical thinking, it can be concluded that the use of Lectora Inspire media affects students' critical thinking. Research conducted by Lutfiana, Susilawati supported the results of this study. Wawan, which stated that there was an increase in critical thinking of the experimental group students, namely 51% in basic clarification indicators, 49% in the main support indicator, 33% on inference indicators, 65% In the sophisticated clarification of indicators, and 27% in strategy and tactics indicators, as well as through Lectora Inspire learning media, it can also improve students' critical thinking skills [11]. One of the improvements in critical thinking skills is that students in the learning process tend to be able to decide the right strategy to overcome a light wave problem. This is in line with Ennis' statement that critical thinking is reflective and reasonable thinking that is focused on deciding what to do[4].

CONCLUSIONS

There is an effect of using Lectora Inspire to increase students' critical thinking skills. The critical thinking skills of the experimental group students increased in the medium category (n-gain 0.5), while the control group was in a low category. Student response to the use of media is very good (83%). Researchers recommend using Lectora Inspire as a support for interactive learning to create active and fun learning.

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