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Effectiveness of STEM-Based Lectora Inspire Media to Improve Students' HOTS in Physics Learning

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Abstract

This study aimed to determine the effectiveness of STEM-based lectora inspire media to improve the student's higher order thinking skills (HOTS). This research design was Research and Development (RnD). This research referred to the ADDIE model that included Analysis, Design, Development, Implementation, and Evaluation. The data were gathered through questionnaires and tests. The questionnaire technique was used to test the feasibility of the material and media used. At the same time, the test instrument was used to determine the increase in students' HOTS based on the final results after using the product. The results showed that the developed media was categorized as feasible to be used as a student learning media with an average score of 93.745% of material expert judgment and 87.485% of media expert judgment. The responses of science teachers and students as users were 91.66% and 87%. Both concluded that the learning media was efficient. Paired sample t-test resulted in a significance value of 0.000 < 0.005, and the N-Gains test yielded a value of 58%. Thus, it can be concluded that STEM-based Lectora Inspire Media can improve the student's higher order thinking skills (HOTS).

Keywords: HOTS, STEM, lectora inspire media, research and development

INTRODUCTION

Education is a planned activity to develop the competence of students. The purpose of education as stated in The National Education System Act 2003 is to create learning activities that are carried out consciously, planned, and directed so that students can develop the skills they are interested in and have. Thus, every educational institution is expected to provide services and facilities so that the objectives of The National Education System (No. 20/2003) can be realized. According to (Rahmi et al. 2019) the components that support educational goals include infrastructure, environment and resources. In addition to these components, technology also has an important role in the success of achieving educational goals. (Hardiyana 2016); (Hartati 2018); (Pujiastuti 2020) stated that using the right technology will affect, improve, and even positively impact the quality of education. The development of technology provides benefits, one of which is able to reduce the performance of the pursuer in learning activities. Because with the right use of technology, the function of the teacher turns into a facilitator and the material that will be given to students becomes easier to convey (Awalia et al. 2019).

Some of the results of previous studies have the similiar opinion, such as (Fitriyadi 2015; Rahmawati & Suryadi 2019; Osborne et al. 2019) if a teacher is able to concurrently serve as a teacher and also as an expert facilitator, it will certainly make the learning carried out run effectively and

efficiently can, but if teachers are not able to be facilitators of students in learning, so learning will not run effectively and efficiently as expected. (Junaidi 2020) mentioned that teachers who can become facilitators are teachers who can be creative in use, development and even create learning media that can help them achieve predetermined learning objectives.

The development of technology is a characteristic of the industrial revolution 4.0, which requires humans to be creative and able to develop themselves as superior human beings and ready to face the challenges of globalization (Liao et al. 2018; Lase 2019). In addition to technological developments, it also needs to be balanced with supporting skills such as being tired of using media and ICT. In the world of education itself, technological developments have begun with the use of modern-based learning media, such as online and offline learning media, which uses technology such as cell phones, tablets, laptops, and computers. Fierce competition in modern globalization in the era of the industrial revolution accompanied by changes in the 21st century, researchers see an opportunity to overcome these problems, namely the need for education that carries elements of science, technology, engineering and mathematics or the summarized STEM (Sudirman 2018); (Zulaiha & Kusuma 2020); (Syahirah et al. 2020). The first STEM element, science, is a branch of science obtained through scientifically proven proof/experimentation. This branch of science includes Biology, Chemistry, Physics, and Earth Sciences. The second element of *Technology* is equipment/media/goods developed/created by humans to facilitate human work. *Engineering* is a way for humans to do engineering, which consists of a combination of science and technology that is beneficial to human life. The last is *mathematics*, a connecting science for other sciences, especially exact ones such as science, technology and *engineering*. Some of the results of previous research answered by the use of STEM-based learning to provide opportunities for students to explore relevant or meaningful experiences through disciplines so as to shape the personality of students to think critically, logically and systematically, on the other hand with STEM skills students related to the use of media, technology and information (ICT) are able to increase in accordance with the demands of the 21st century era (Irmita 2018; Thibaut et al. 2018; Sriyati et al. 2018; Setiyani 2022; Sukmagati et al. 2020).

One implementation of the STEM approach can be presented through interactive media.

Some of the results of previous research studies *lectora inspire* have a positive impact on learning, (Akbarini et al. 2018) stated that the results of their research used *lectora inspire* 87.5% of education practitioners stated that it was like a learning medium. In line with these results, other researchers such as (Saputro et al. 2020) 84 % *of lectora inspire* media are categorized as feasible as learning media in physics subjects and tested in improving the learning outcomes of students who initially fall into the low category, in addition to that (Simorangkir & Sembiring 2018) stated that the number sense in troubleshooting. Based on this study, researchers see that no research focuses on the development of STEM-based *lectora inspire*.

Apart from problems based on technology and the demands of the times, researchers also found one real problem based on teachers' experiences at one of the private junior high schools in Semarang City whom researchers had interviewed through preliminary research. The activity concluded that the low skill of *HOTs* or the ability to think at a high-level result in a lack of value obtained by students. The low HOTs of students is also experienced by several schools, especially after the Covid-19 pandemic. In the pre-pandemic exam, the percentage of critical thinking skills was 21% in the less facilitating category; during the pandemic, it was 9.9% in the non-facilitating category. And the lowest skills are decision-making skills (Wirahmawati et al. 2022). From the problems outlined above, in addition to developing *lectora Inspire* media with STEM-based, researchers also tested the effectiveness of developing these media for improving students' HOTS. So that the right research title for this study is "Effectiveness of STEM-Based Lectora Inspire Media to Improve Students' HOT Skills in Physics Learning".

METHODS

This research was a Research and Development (RnD) which focuses on product development and testing its effectiveness. This research referred to the ADDIE model that included Analysis, Design, Development, Implementation, and Evaluation (Sugiyono 2017). After the media development stage, the validation stage was carried out. The validity test was carried out on the developed media and the

questions used as data collection instruments. The validity of the developed media is carried out by material experts and media experts. The material expert functions as a corrector to the material that has been compiled on the Lectora Inspire media, while the media expert functions as a corrector to the media that has been compiled by the researcher, in this case the validator plays a role in assessing the media. At the same time, the validity of the questions aims to test the questions that will be used to measure students' HOTS after using the media.

After the validity test was completed, it was continued to conduct a reliability test using Cronbach Alpha with the following equation:

$$r_{11} = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum \sigma_b^2}{\sigma_t^2}\right] \quad (1)$$

Explanation

r_{11} = instrument reliability coefficient
k = number of items about valid/valid questions
$\sum \sigma_b^2$ = number of grain variances
σ_t^2 = variance of the total score

The calculation results using Cronbach Alpha were converted into reliability level criteria by referring to TABLE 1 below.

TABLE 1. Reliability Level Criteria (Arikunto 2016)

Value	Criteria
$r_{11} < 0.20$	Very Low
$0.20 \leq r_{11} < 0.40$	Low
$0.40 \leq r_{11} < 0.70$	Middle
$0.70 \leq r_{11} < 0.90$	High
$0.90 \leq r_{11} < 0.40$	Very High

Data collection techniques used by researchers include the questionnaire and test instruments. The questionnaire instrument aimed to collect data related to materials and media that have been compiled and designed, therefore, the questionnaire instrument is tested to material and media expert. While the test instrument was used to determine the increase in students' HOTS based on the final results after using the product. The test technique here is a *Three Tier Multiple Choice* type *posttest* test technique carried out after using *Lectora Insipire* media. While the pretest used was the result of the student's final exams during first semester. The pretest and posttest results obtained were analyzed using the N-Gains equation to see the increase in lstudents' HOTS.

Then, related to data analysis techniques consisting of data analysis techniques that are used to analyze the results of the distribution of questionnaires or questionnaires to determine the feasibility of developing the product that the researcher performed, the researcher calculated using the percentage equation as follows:

$$P = \frac{x}{\sum x} x100\ \% \quad (2)$$

Then the researcher categorizes the results based on TABLE 2 and 3 as follows:

TABLE 2. Material and Media Eligibility Categories (Arikunto 2016)

Percentage	Category
76 % - 100 %	Very feasible
51 % - 75 %	Feasible
26% - 50%	Quite feasible
0 % - 25 %	Not-feasible

TABLE 3. Percentage of Teacher and Learner Responses (Arikunto 2016)

Percentage	Category
76 % - 100 %	Very Practical
51 % - 75 %	Practical
26% - 50%	Pretty Practical
0 % - 25 %	Impractical

Furthermore, the N-Gains Score equation was used to determine the effectiveness of STEM-based lectora inspire media against HOTS where the experimental class was calculated *the Posttest-Pretest* difference. The N-Gains Score equation:

$$< g > = \frac{rerata\ Postest - retata\ Pretest}{Skor\ Max - rerata\ pretest} \quad (3)$$

The category of the N-Gains Score with TABLE 4 interpretations of effectiveness as follows:

TABLE 4. Categories Media Effectiveness (Arikunto 2016)

Percentage	Category
< 40 %	Ineffective
40 % - 55 %	Less Effective
56 % - 75 %	Effective
> 76 %	Highly Effective

TABLE 5. Gains Score-Category (Arikunto 2016)

Percentage	Category
g > 0.7	High
0.3 ≤ g ≤ 0.7	Middle
g < 0.3	Low

RESULTS AND DISCUSSION

Result

Needs Analysis Results

The initial step to conduct this study was based on the analysis of needs that occur in the field. The subject in this study was the low of students HOTS in understanding science material and the object in this study was the Empu Tantular Middle School Semarang. The problem has been obtained by researchers from a preliminary-research activities that have been carried out before researchers determine the learning media used. The preliminary-research conducted by direct observation at Empu Tantular Junior High School coupled with direct interview to the science teachers.

After determining the research problem, the researcher analyzed the right media used to overcome the problems that occur in the field. Based on several references obtained, researchers determined an interactive medium, namely *Lectora Inspire*. Researchers were interested in the development of this media because several references explain that the interactive media, one of which is *Lectora Inspire*, is able to improve students' critical thinking skills. In addition to this, researchers see facts in the current events, namely the problem of the 21st century where in the problem of the 21st century, namely emphasizing 4C skills and skills in the use of technology. Although *the Lectora Inspire* media has been widely studied in other studies, researchers see an opportunity that there was no development of STEM (*Science, Technology, Engineering, Math*)-based *Lectora Inspire* media.

Design Stage

After the needs analysis stage has been carried out, the next step was the *lectora Inspire* media design stage. Because the focus of this research was on learning science in junior high school, the researchers designed Lectora Inspire media that were adapted to the science material "Vibration and Waves" in class VIII Semester 2. Here's a look at the *Lectora Inspire* 18.

FIGURE 1. Design Media Lectora Inspire 18

Development Stage

At the development stage, the media has been made but the feasibility of the media has not been validated to be used by teachers and students. At the development stage, material validation was carried out by 2 material experts and media validation was carried out by 2 media experts. The selection of validators was based on predetermined criteria such as: material validators with minimum criteria of Masters in Science or Physics Education and media validators come from lecturers with minimum criteria for masters of education with experience in developing media. The results of material validation are presented in TABLE 6 as follows.

TABLE 6. Material Expert Validation Results

No	Elements	Expert 1 (%)	Expert 2 (%)
1	Introduction	30.55	31.94
2	Fill	45.88	47.22
3	Cover	15.25	16.66
Sum		91.66	95.83
Average		93.745	

The result of material validation from material expert 1 was 91.66% and material expert 2 was 95.83%. The average result of the two validators was 93.745. According to TABLE 1, these results were included in the “very feasible” category. Thus, it could be concluded that the material presented on the Lectora Inspire media was in accordance with the basic competencies and learning objectives so that the media was very suitable for use in learning.

After material validation was carried out, it was continued by conducting media validation. The following result of media validation was shown in TABLE 7 as follows.

TABLE 7. Media Expert Validation Results

No	Elements	Expert 1 (%)	Expert 2 (%)
1	App Introduction	26.38	29.16
2	Graphical Display	63.88	55.55
Sum		90.26	84.71
Average		87.485	

The results validation of the developed media get a score of 90.26 from media experts 1. According to TABLE 1. this value is categorized as very feasible. Meanwhile, the validation result from media expert 2 is 84.71 so it is categorized as very feasible. Thus, the average result of the assessment by media experts is 87.485 and was categorized as very feasible based on TABLE 1. Thus, Lectora Inspire media was categorized as very feasible to be tested on users (teachers and students).

Media Implementation Phase

After completing the validator's assessment of the material and media, it was continued with the implementation stage. At this stage, an assessment of media users was carried out. Media users consist of science teachers and students in schools that were the object of research. The instrument for user assessment was a questionnaire. The following Table was the results of STEM-based lectora inspire media assessments that come from science teachers.

TABLE 8. Results of Media Assessment of Science Teacher as Users

No.	Elements	Teacher 1	Teacher 2	Teacher 3
1	Clarity	31.03	31.86	31.03
2	Interest	25.86	26.71	24.13
3	Language	19.82	20.68	17.24
4	Material	14.65	15.51	16.37
	Sum	91.37	94.82	88.79
	Average		91.66	

Based on the data that has been obtained from the science teacher's response to the Lectora Inspire media that has been developed, it was known that the average teacher response is 91.66. According to TABLE 2. this value was categorized as very practical to be applied in science learning.

As for the response of students in the implementation phase, it was collecting student responses after using the Lectora Inspire media using a questionnaire instrument. The following was a TABLE 9 results of student assessments of media users.

TABLE 9. Results of Media User Assessments by Learners

No	Nama (Code)	Elements			Sum
		Interest	Material	Language	
1	PD 1	0.411765	0.25	0.205882	0.86764706
2	PD 2	0.397059	0.264706	0.191176	0.85294118
3	PD 3	0.426471	0.264706	0.220588	0.91176471
4	PD 4	0.411765	0.264706	0.205882	0.88235294
5	PD 5	0.441176	0.279412	0.220588	0.94117647
6	PD 6	0.426471	0.235294	0.220588	0.88235294
7	PD 7	0.411765	0.25	0.191176	0.85294118
8	PD 8	0.397059	0.235294	0.205882	0.83823529
9	PD 9	0.367647	0.25	0.191176	0.80882353
10	PD 10	0.411765	0.235294	0.191176	0.83823529
11	PD 11	0.426471	0.25	0.191176	0.86764706
12	PD 12	0.411765	0.25	0.161765	0.82352941
13	PD 13	0.411765	0.25	0.191176	0.85294118
14	PD 14	0.411765	0.279412	0.191176	0.88235294
15	PD 15	0.426471	0.25	0.220588	0.89705882
16	PD 16	0.411765	0.235294	0.191176	0.83823529
17	PD 17	0.397059	0.279412	0.191176	0.86764706
18	PD 18	0.441176	0.294118	0.191176	0.92647059
19	PD 19	0.411765	0.264706	0.191176	0.86764706
20	PD 20	0.382353	0.279412	0.205882	0.86764706
21	PD 21	0.411765	0.264706	0.205882	0.88235294
22	PD 22	0.426471	0.264706	0.191176	0.88235294
23	PD 23	0.397059	0.264706	0.205882	0.86764706
24	PD 24	0.426471	0.25	0.191176	0.86764706
25	PD 25	0.397059	0.264706	0.220588	0.88235294
Average		0.411765	0.258824	0.199412	0.87
Percent		41.17 %	25.88 %	19.94 %	87 %

TABLE 9 contains of student responses while using STEM-based Lectora Inspire media. From 25 student respondents, it was known that the average interest in using STEM-based Lectora Inspire media was 0.411765; in terms of the material presented, it was obtained 0.258824 and in terms of language it

was obtained 0.199412 so that the overall average obtained is 0.87 or 87%. Furthermore, the results were interpreted in TABLE 2. so that it can be concluded that the responses from students about the media that have been developed were "very practical".

Evaluation

At this stage, the improvement in Posttest results was analyzed after learning using Lectora Inspire media. At this stage, HOTS level cognitive test was used in the form of multiple-choice questions using the Three Tier Test type. In the test, students not only choosed the answer choices provided, they also wrote down the reasons for choosing the answers and beliefs about the answers they choose.

After the multiple-choice HOTs cognitive instrument was prepared, the instrument was not directly given to class VIII C (experimental class). The test was first tested for validity and reliability. In this case, the class used to test the validity and reliability of the instrument was class VIII A. The results of the validity and reliability tests can be presented in TABLE 10 and 11.

TABLE 10. HOTs Instrument Validity Test

No Question	R_{count}	R_{tabel}	Information
1	0.739		Valid
2	0.578		Valid
3	0.498		Valid
4	0.610		Valid
5	0.776		Valid
6	0.117		Invalid
7	0.394		Valid
8	0.692		Valid
9	0.255		Invalid
10	0.472		Valid
11	0.293		Invalid
12	0.600		Valid
13	0.462	0.374	Valid
14	0.505		Valid
15	0.267		Invalid
16	0.520		Valid
17	0.670		Valid
18	0.130		Invalid
19	0.411		Valid
20	0.484		Valid
21	0.379		Valid
22	0.496		Valid
23	0.398		Valid
24	0.430		Valid
25	0.071		Invalid

Based on TABLE 10. it is known that from the 25 questions there are 19 questions with valid criteria (questions number 1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 16, 17, 19, 20, 21, 22, 23, 24) and 6 questions with invalid criteria (questions number 6, 9, 11, 15, 18 and 25). Questions with valid criteria were used in the posttest, while questions with invalid criteria were not used in the study.

The next stage was reliability testing which aims to ensure whether the instruments that have been prepared were consistent for use in data collection. The following is the result of the reliability tests that have been carried out in TABLE 11.

TABLE 11. Reliability Test Results

Croncach's Alpha	N of Items
0.873	19

The result of the calculation of the reliability test was 0.873. According to TABLE 1, the reliability value was included in the high category. So it can be concluded that the instrument can be used as a data collection instrument in this research.

The last stage in this study was to collect posttest data in the class that was given special treatment, namely in class VIIIA. The result of the increase in value was calculated through the N-Gains equation. Prior to the N-Gains test, it was necessary to test the normality of the data. Then a paired sample t-test was conducted to determine whether there was an effect of using STEM-based Lectora Inspire media on students' higher-order thinking skills. The following are the results of the normality test and the paired test of the t-test sample.

TABLE 12. Normality Test

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**Df**	**Sig.**
Pretest	.153	30	.070	.936	30	.069
Posttest	.143	30	.117	.945	30	.124

Based on TABLE 12 of the normality tests that have been carried out, it is known that the *pretest* signification value was 0.069 and the *posttest* signification value was 0.124. The signification value was greater than 0.05 so that it can be concluded that the *pretest* and *posttest* data are distributed normally and can be continued with parametric statistical tests, namely paired tests sample t-test to determine whether there is an effect on the use of STEM-based *lectora inspire* media. The following are the statistical test results of the paired test of the t-test sample.

TABLE 13. Paired Sample T-Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	**Std. Deviation**	**Std. Error Mean**	**Lower**	**Upper**	**T**	**df**	**Sig. (2-tailed)**
Pair 1	Pretest - Posttest	-28.200	11.309	2.065	-32.423	-23.977	-13.658	29	.000

The results of the calculation of the paired sample t-test in TABLE 13 show that the significance value (2 tailed) was 0.000 <0.05 so it can be concluded that there was a difference between classes that use STEM-Based Lectora and those who do not. This shows that the use of STEM-based inspiration lectora media affects the posttest results. The next analysis was the N-gains test to determine the profile of students' higher order thinking skills before and after treatment. Here are the results of the N-Gains test calculation.

TABLE 14. N-Gains Calculation Results

No	Student Code	Pretest	Posttest	N-Gains	Category
1	PD 1	32	74	0.613	Middle
2	PD 2	38	68	0.49	Middle
3	PD 3	72	89	0.624	Middle
4	PD 4	50	74	0.473	Middle
5	PD 5	56	89	0.76	High
6	PD 6	82	95	0.707	High
7	PD 7	46	53	0.122	Low
8	PD 8	48	68	0.392	Middle
9	PD 9	74	95	0.7975	High
10	PD 10	40	79	0.649	Middle
11	PD 11	46	74	0.512	Middle
12	PD 12	44	89	0.812	High
13	PD 13	36	63	0.424	Middle
14	PD 14	48	68	0.392	Middle
15	PD 15	36	74	0.588	Middle
16	PD 16	74	89	0.595	Middle
17	PD 17	62	84	0.584	Middle
18	PD 18	50	95	0.894	High
19	PD 19	70	84	0.473	Middle
20	PD 20	40	63	0.385	Middle
21	PD 21	40	74	0.561	Middle
22	PD 22	60	79	0.473	Middle
23	PD 23	48	89	0.797	High

No	Student Code	Pretest	Posttest	N-Gains	Category
24	PD 24	52	89	0.78	High
25	PD 25	30	79	0.699	Middle
26	PD 26	44	79	0.624	Middle
27	PD 27	52	84	0.671	Middle
28	PD 28	74	84	0.392	Middle
29	PD 29	42	79	0.637	Middle
30	PD 30	60	89	0.736	High
Average				0.589	Middle
Percentage				58.9	Quite Effective

Based on the results in TABLE 14 of the N-Gains Calculation, a percentage of 58.9% was obtained, which if consulted with TABLE 4, it can be said that STEM-based *Lectora Insipre* media was effective in improving the ability of student HOTs. Meanwhile, when viewed from the profile of students' conclusions in improving HOTs skills, it can be categorized as moderate.

Discussion

This research was a Research and Development (RnD) which focuses on product development and testing its effectiveness. In this case, the researchers developed STEM-based Lectora Inspire learning media to improve students' HOTS. This research was conducted by developing STEM-based Lectora Inspire because: 1) changing times required students to be proficient and skilled in 4C (Communication, Collaboration, Critical Thinking and Problem Solving, and Creativity and Innovation) and in the use of technology; 2) the low of students higher order thinking skills in solving problems, which has been proven through preliminary research before the researchers determined the STEM-based Lectora Inspire media to be developed and used in this study.

After finding the root of the problem faced by the teacher through preliminary research, the researcher looked for references in solving the problem. Based on some references, it was found that the use of Lectora Inspire media was effective in learning (Umarella et al. 2019; Ginting et al. 2021; Irsan et al. 2022). However, the use of STEM (Science, Technology, Engineering and Mathematics)-based lectora Inspire media has not been found. So, the purpose of developing STEM-based Letora Inspire media was to fulfill the STEM rules. In the science dimension, the developed media presents exact science material, namely vibration and wave material. In the technology dimension, the emphasis was on the ability to use technology such as PC, laptop, cellphone, and tablet for the learning process. For the Engineering dimension, this media emphasized examples of the use of vibrations and waves in everyday life. While, for the mathematical dimension, it emphasized simple mathematical calculations in the concepts of vibrations and waves.

The next step was the development of STEM-based Lectora Inspire media using the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model. The analysis phase was carried out by analyzing the problems faced and determining problem solving strategies by choosing STEM-based Lectora Inspire media. The second stage was designing and developing media by testing construct validity by involving material experts, media experts, and teachers and students as users. The material expert was chosen with the consideration of at least a master's degree in science and physics education in accordance with the material used in the product being developed. The assessment score of material expert 1 was 91.66% and material expert 2 was 95.83%, so the average score of both material experts was 93.745%. This can be interpreted that the material used was in accordance with the material in the Kurikulum 2013. Meanwhile, media experts involved were educational practitioners such as lecturers in education. The result of media expert 1 was 90.26% and media expert 2 was 84.71%, so the average of media experts was 87.485% which means that the media that researchers have developed was very feasible to use for the data collection process.

After the media has met the expert assessment stage, the next stage was the implementation of the media in physics learning. At this stage, data were collected from science teachers and students as users through a questionnaire. Based on the results obtained, the percentage of responses obtained from the science teacher questionnaires was 91.66% which can be categorized that the developed media was

very practical to use, while the results obtained from students who have used the media was 87% which can also be categorized as very practical.

The last step of this research was the evaluation stage. At the evaluation stage, the researcher applied questions arranged at the HOTS (Higher Order Thinking Skills) level by referring to the Revised Bloom's Taxonomy. According to Rasyid et al (2020) HOTs are divided into 4 parts: the ability to solve problems, make the right decisions, think critically and think creatively. Yustina and Imam Mahadi (2021) explain four aspects of the criteria for someone who is said to be able to think creatively, namely 1) Fluent Thinking (ability to think of solutions to problems faced in various ways), 2) Flexible Thinking (the ability to think about developing views on the information obtained so that new ideas arise related to the problems faced), 3) Original Thinking (thinking that gives rise to new, unique ideas that have not previously been thought of by others) and 4) Elaboration Ability (skill of combining various strategies, ideas or methods to produce new and unique ways). To measure the students' HOTS, a test instrument was used in the form of a three-tier test, meaning that the development of the test used with three levels in the form of multiplechoice test questions, confidence in the answers given, and the basic reasons for choosing the answers. Before the test was given to the experimental class students, the test was tested on students in other class. Of the 25 questions tested, 19 were valid and 6 were invalid. Questions with invalid criteria were not used in data collection. Then, the reliability value was calculated on valid questions and the results were 0.873, which means 19 questions with valid criteria can be trusted as data collection instruments in this study.

To test the effectiveness of STEM-based Lectora Inspire media in improving students' HOTS, researchers conducted a parametric test in the form of paired sample t-test and N-Gains test. Before conducting the parametric test, it was necessary to test the normality of the pretest and posttest data. The pretest data used by the researcher was the data from the test results before data collection. While the posttest data obtained from 19 questions that have been tested for validity and reliability. The results of the normality test were known to have a pretest value of 0.067 and a posttest value of 0.124 which is compared with a comparison value greater than 0.05 so that it can be concluded that the pretest and posttest values ware categorized as normal. For this reason, the data can be tested parametrically using a paired samples t-test. The results of the parametric test paired test paired samples t-test obtained results of 0.000 (< 0.05) and can be concluded that STEM-based *Lectora Inspire* media had an influence on the students' higher order thinking skills (HOTS). The last test was to determine the profile of student HOTS after using STEM-based *lectora inspire* media and the effectiveness of STEM-based *lectora inspire* media on the students' HOTS using the N-Gains test with an average result of 0.589 which means that the average hots skill profile of students has increased after using *lectora inspire* media STEM-based with Moderate outcomes, and the effectiveness of STEM-based *lectora inspire* media in improving studentsrs' HOTS by 58.9% which can be categorized as effective in improving students' HOTS.

CONCLUSION

Based on the results of research on the effectiveness of STEM-based lectora Inspire media to increase student HOTS that has been implemented, it is proven that STEM-based inspirational lectora media is effective for increasing student HOTS. This study examines the content that has been compiled by researchers and tests the feasibility of the model that has been carried out, namely STEM. Based on the results of the feasibility test conducted to determine the feasibility of the media being developed as a learning resource for students. The results showed that the developed media was categorized as very feasible to be used as a student learning media with an average score of 93.745% for material expert assessment and 87.485% for media expert assessment. Furthermore, the responses of science teachers and students as users were 91.66% and 87%, both of which concluded that learning media was very practical. In addition, higher order thinking skills (HOTs) have also increased after using STEM-based Lectora Inspire media. The paired sample t test yields a significance value of 0.000 <0.005 and the N-Gains test yields a value of 58%. Thus, it can be concluded that STEM-based Lectora Inspirational Media can improve students' Higher Order Thinking (HOTS) abilities.

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