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<http://jurnal.untan.ac.id/index.php/PMP>**THE EFFECT OF LCDS-BASED INTERACTIVE E-SCHOOLBOOK (ESB) AGAINST HOTS AND SCIENTIFIC ATTITUDE OF STUDENTS****Annisa Tasya Marsakha¹, Agus Suyatna², Kartini Herlina³**

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DOI: dx.doi.org/10.26418/jpmipa.v11i1.32957**Abstract**

This study was aimed to determine the effect of the use of LCDS-based interactive electronic schoolbook (ESB) on atomic nuclei material with a scientific approach to Higher Order Thinking Skill (HOTS) and scientific attitudes of students and to investigate the average HOTS value of students after both using interactive and non-interactive ESB. The research design was a Non-equivalent Control Group Design, involving students as the research subjects from one of the State High Schools in Kotabumi, with XII IPA 5 as an experimental class and XII IPA 4 as a control class. Data processing techniques were performed by T-test. The results of the HOTS pretest-posttest students in the experimental class revealed that the Sig. (2-Tailed) value was smaller than 0.05, which was equal to 0,000, indicating that there was an effect of the use of LCDS-based interactive ESB with a scientific approach to the material of the atomic nuclei on HOTS students. The test results of the differences in scientific attitudes of students between the two classes enclosed that the Sig. (2-Tailed) value of 0.001 was smaller than 0.05. This implied the great influence of the use of LCDS-based interactive ESB on the scientific attitude of students. HOTS results of students in both classes also obtained the Sig. (2-Tailed) value of 0,000, stating that there was a significant difference in the average N-gain HOTS value of students who learned with LCDS-based interactive ESB against the non-interactive model.

Keywords: Interactive ESB, LCDS, Atomic Nuclei, HOTS, Scientific Attitude

The development of technology in Indonesia has increased rapidly, wherein this century it is known as the era of Information and Communication Technology (ICT). ICT-based learning cannot be separated from the 21st-

century demands, which integrates ICT in the learning process (Yusuf, *et al.*, 2015).

ICT-based learning media can help teachers throughout the learning process, both in conveying information and

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transferring knowledge to students which are packaged in such a way from abstract to concrete, which make the learning process more enjoyable (Halidi, *et al.*, 2015). This is very helpful in the learning process because the teacher can easily display a variety of learning materials, which previously only through texts and pictures, yet becoming real look, thus making students more interested in learning. Sukiman (2012) also stated that learning media can be used to channel messages or information, so this stimulates students' thoughts, interests, feelings, concerns, and wishes to achieve learning objectives effectively.

Wibowo, *et al.*, (2014) suggested that with the development of current technology, it is necessary to insert multimedia contents into electronic books. E-books are usually informative, but there are also interactive ones, which are related to two-way communication, active cooperation, interconnection and reciprocity with one another. The interactive e-book can support students to play a more dynamic role in the physics learning process. Akbas, *et al.* (2013) added that the use of interactive media in learning results in higher learning outcomes compared to using conventional media.

Physics basically contains various facts, principles, theories, and laws that have strong evidence obtained from a series of scientific activities. Also, physics learning must first introduce the real application of the concepts before new mathematical equations used to solve a problem. Physics learning that continues to develop must be supported by media that can help students more easily understand abstract physics concepts, which is supposed to be dynamic media, that not only display

texts and images, but also provide features that make students easier to understand the materials. One of the media that can support this learning concept is an interactive Electronic School Book (ESB) based on the Learning Content Development System (LCDS). LCDS-based interactive ESB is an electronic book designed with various features that both present texts and images, including animations, simulations, videos and other multimedia.

The results of an interview with one of the physics teachers and students of the eighth-grade class in one of the Kotabumi State High Schools showed that the source of learning at the school only relied on printed books or textbooks. Students are only provided with practice questions, especially those for exams and college entrance preparation; and with limited study time at schools in the class on even semester makes teachers only present and explain the materials briefly and which are predicted to come out during exams, so this causes the lack of training on students to think at a higher level. In addition, one of the materials which is not enough to be only explained without the presence of a media that can help in the learning process is the material of the atomic nuclei, because it is quite abstract in nature; in the material there are various kinds of sub-materials such as atomic structure, core-binding energy, permeability, radiation hazards, nuclear reactions and so on, thus we need a media that can motivate students to more easily observe a phenomenon of atomic nuclei.

The results of previous studies conducted by Sari, *et al.*, (2013) stated that learning by using interactive learning media on the material of static

electricity influenced the increase of average pretest-posttest marks of students in one of Bandar Lampung Public Middle Schools. Simamora, *et al.* (2017) also added that the use of LCDS-based interactive electronic school book (ESB) had an impact on increasing the value of the pretest-posttest in students, which showed that learning using LCDS-based interactive ESB greatly impacted on student learning outcomes in one of Bandar Lampung State High Schools.

LCDS-based interactive ESB has advantages over non-interactive ESB. The advantages include not only text and images display, but also animations, simulations and videos that present various phenomena about atomic nuclei, such as the binding energy of atomic nuclei, penetrating power, nuclear reactions and so on, thus encouraging students to be able to analyse, conclude and communicate through their ideas. As a result, this stimulates students to think at a higher level (HOTS).

Hutagalung, *et al.* (2016) stated that LCDS-based interactive ESB on impulse and momentum material, equipped with various features such as video, animation, and simulation, were effectively used as learning media resulting in an average gain value of 0.57. This suggested that LCDS-based interactive ESB is more attractive to students, and students are more interested and enthusiastic in learning activities compared to the use of non-interactive ESB; consequently, the average learning outcomes in the experimental class were higher than the control class using non-interactive one.

This is also supported by research conducted by Suyatna, *et al.* (2017) which demonstrated that the average student learning outcomes with the

application of dynamic visualization media were significantly higher than those applying static visualization media. Other studies also reinforced this research, by Lora, *et al.* (2018), exhibited that learning using 3D animation media on the materials of impulse and momentum obtained higher N-gain compared to those using only 2D media.

This indicated that learning by using 3D animation makes students easier to understand a material resulting in average learning outcomes which were higher than the use of 2D animation media.

Therefore, this study was aimed to (1) determine the effect of the use of LCDS-based interactive ESB on students' HOTS, (2) to define the impact of the use of LCDS-based interactive ESB on students' scientific attitudes, and (3) to investigate the differences in the average HOTS of students after using interactive and non-interactive ESB.

METHOD

This study was performed with a Non-equivalent Control Group Design, using two classes, the experimental class and the control class, as research samples. Sampling was done by purposive sampling technique. The experimental class was treated using LCDS-based interactive ESB on atomic nuclei material (X1), while the control class was treated with non-interactive ESB (X2). Learning activities were carried out with 3 meetings in both the experimental class and the control class. Before learning began, students were given pretest questions to measure students' initial abilities and posttest questions after learning.

The population in this study were all students of eighth-grade class of

Natural Sciences in one of the Kotabumi State High Schools in the even semester of the academic year 2018/2019, using two classes as samples, class XII IPA 4 as a control group and class XII IPA 5 as an experimental group, with a total of 37 students on each. The research design was shown in Table 1.

Table 1. *Non-equivalent Control Group Design*

<i>Pretest</i>	<i>Group</i>	<i>Posttest</i>
O ₁	X ₁	O ₂
O ₃	X ₂	O ₄

This study had two forms of variables, independent and dependent variables. The independent variable in this study was the use of LCDS-based interactive ESB, while the dependent variable was students' HOTS and scientific attitudes. The research instrument used in this study was a questionnaires sheet to determine the HOTS of students, with 8 questions. Assessment of scientific attitudes was executed in a scale system with 20 statements that had been tested in advance using the validity and reliability test.

HOTS students were measured using questions that were in accordance with HOTS indicators, which were analysing (C4), evaluating (C5), and creating (C6). The scientific attitude of students was assessed using statements according to indicators of scientific attitudes, which were curiosity, respect for data, an attitude of doubt, perseverance, responsibility, open-minded, critical, collaboration with others, creative and inventions. HOTS results and scientific attitudes were then tested with a sample t-test.

Hypothesis analysis was evaluated by determining the average pretest and

posttest value both HOTS and the scientific attitude of students; where the determination of students' HOTS scores depends on students' answers with as following categories, Very Complete = 4, Complete = 3, Less Complete = 2, Incomplete = 1 and No Answer = 0. While, the assessment on scientific attitude used a Likert scale, where the scoring of the answer choices in the Likert scale depended on the nature of the statement. For statements that were positive, the answer scores were: SS = 4; S = 3; R = 2; TS = 1; and STS = 0. For statements that were negative, those were the opposite: SS = 0; S = 1; R = 2; TS = 3; and STS = 4. Next, it was followed by the normality test, homogeneity test, paired sample t-test and independent sample t-test. The first hypothesis in this study was related to the average value of pretest-posttest in students with Hypothesis Null (H₀), indicating there was no difference in the average pretest and posttest using LCDS-based interactive ESB on the atomic nuclei material with a scientific approach, and Hypothesis Alternative (H₁) implying there were differences in the average pretest and posttest using LCDS-based interactive ESB on the same material and approach.

The second hypothesis was related to the average values of scientific attitudes in students with (H₀), indicating that the use of interactive ESB was less than or equal to the average scientific attitude values of students with non-interactive ESB, and (H₁) implying that the average scientific attitude of students with interactive ESB was greater than non-interactive ones. The third hypothesis was linked to the average of HOTS values in students with (H₀), suggesting that the average HOTS of students with interactive ESB was less

than or equal to non-interactive ones, and (H1) inferring that the average HOTS of students with interactive ESB was greater than non-interactive one. The used testing criteria were as follows: if p-value > 0.05, H0 was accepted; and if p-

value < 0.05, H0 was rejected (Sugiyono, 2015).

RESULTS AND DISCUSSION

Based on this current finding, the results of HOTS and scientific attitude of students were displayed in Table 2.

Table 2. Average Data of *HOTS* dan Scientific Attitude

Mark Category	Experimental Class	Control Class
<i>Pretest</i> Mark Average	38,0	38,1
<i>Posttest</i> Mark Average	80,7	77,0
N-Gain Average	42,7	38,9
N-Gain Mark Average	0,69	0,63
Scientific Attitude Average	3,53	3,40

Normality and homogeneity tests were then conducted in accordance with the average values obtained from Table 2. The results of the normality test of HOTS N-gain in students in the experimental and control class revealed a significance value of 0.200. The results of the normality test of scientific attitudes in the experimental class enclosed a significance value of 0.200, while the control class exhibited a value of 0.113. Based on the assessment criteria, HOTS and scientific attitudes data of students in classes using both LCDS-based interactive ESB and non-interactive ESB were normally distributed, where the significance value obtained was >0.05.

The results of the homogeneity test on the HOTS and scientific attitude of students from both classes obtained significance values of 0.147 and 0.992, respectively. This suggested that the data was homogeneous, according to the assessment guidelines; if p-value is

>0.05, two variance data are homogeneous (Triyono, 2013).

The first hypothesis test results using paired sample t-test were shown in Table 3, with the acquisition of a significance value of less than 0.05 which was equal to 0,000. This revealed that the value of Sig. (2-tailed) was less than 0.05, which implied that H0 was rejected, resulting in the presence of differences in the average pretest and posttest using LCDS-based interactive ESB on atomic nuclei material with a scientific approach. In this LCDS-based interactive ESB, there were images and animations present helping students in analysing a problem; in addition, there were also videos of translucency, determination of radioactive age, and nuclear reactors. The existence of the video contents assists students in analysing and concluding a phenomenon. This was consistent with the HOTS indicators, analyse (C4) and conclude (C5).

Table 3. The Results of Difference Test of *HOTS* in Experimental Class

	T	Df	Sig. (2-tailed)
Pretest and Posttest Values of Experimental Class	36,80	36	0,000

This is in accordance with the studies conducted by Purwanto, *et al.* (2013), in one of Sabawi High Schools, stating that learning by using interactive multimedia in the material of dynamic electricity (not only displaying texts and images) was effectively used, because it can improve student learning outcomes, by obtaining an average pretest of 33.39, which was significantly different from the posttest average of 89.69. Kurniawan, *et al.* (2015) added that in interactive multimedia (interactive ESB), there were various features such as images, animations, simulations, and videos found in it. Hence, students could practice independently through the questions found in the interactive ESB. Learning in the classroom occurred systematically and was very directed.

LCDS-based interactive ESB facilitates students to learn independently by trying directly each feature provided in the system because it is equipped with a usage guide. Moreover, this interactive e-book has a positive impact on student learning outcomes, with the differences in the average N-gain of the experimental class of 0.55 and the control class of 0.45. Based on some of these opinions indicated that the use of interactive multimedia, especially LCDS-based

interactive ESB, is effectively implemented in the learning process because it reveals a significant effect on student learning outcomes.

Test differences in scientific attitudes were carried out to test the second hypothesis shown in Table 4, with a significance value obtained of 0.001. This implied that H0 was rejected, suggesting that the average scientific attitude of students with LCDS-based interactive ESB (experimental class) was greater than the average scientific attitude of students with non-interactive ESB (control class). As a result, LCDS-based interactive ESB has more effects over non-interactive ESB, in which LCDS-based interactive ESB not only provides texts and images but also does with simulations, interactive questions, animations and videos by exhibiting various phenomena about the nucleus. This exerts students to have a positive scientific attitude, especially towards physics, where students will tend to be more active in learning activities, tend to have a high curiosity about a problem, tend to think more critically about an event, and tend to be creative about physical problems as well as respect data that has been obtained.

Table 4. The Results of Difference Test of Scientific Attitude

<i>T-test for Equality of Means</i>			
	T	Df	Sig. (2-tailed)
<i>Equal variances assumed</i>	3,455	72	0,001
<i>Equal variances not assumed</i>	3,455	60,534	0,001

This is relevant to the research conducted by Rachmad, *et al.* (2017) at one of the Terbanggi Besar State High Schools, stating that the average N-gain of student learning outcomes in the affective domain using LCDS-based interactive ESB in the material of temperature and heat were higher than using printed books and worksheets. The comparison between the average N-gain of student learning outcomes in the affective domain using the LCDS-based interactive ESB with printed books and worksheets was 0.6:0.3.

Saregar, *et al.* (2013) reinforced this current studies, demonstrating that learning using interactive media in the material of impulse and momentum supports students having a good scientific attitude, which students are active in the learning process, have high curiosity and are motivated to think critically in responding to an event or phenomenon.

The HOTS difference test was conducted to test the third hypothesis shown in Table 5. Based on the test results, it was obtained a significance value of less than 0.05, which was equal to 0,000. This indicated that H0 was rejected, suggesting that the average HOTS of students using interactive ESB was greater than using non-interactive model. This implied that there was an effect of the use of LCDS-based interactive ESB on atomic nuclei material on HOTS students. In this interactive ESB, there were features such as animations of helium nuclei and light in the magnetic field which help students to observe and analyse a phenomenon, so students are able to consider arguments about the material of the atomic nuclei and the properties of radioactive rays. This is in accordance with the HOTS indicators, which is analysing (C4).

Tabel 5. The Results of Difference Test of *HOTS*

<i>T-test for Equality of Means</i>			
	T	Df	Sig. (2-tailed)
<i>Equal variances assumed</i>	4,560	72	0,000
<i>Equal variances not assumed</i>	4,560	67,259	0,000

Also, Aulia, *et al.* (2017) supported these findings stating that, after the effectiveness test of students who have used the interactive ESB as a learning medium, this interactive ESB model with LCDS programs in the material of the movement kinematics was effectively used, by obtaining an average N-gain of 0.53. Other studies asserting this current research, conducted by Dinafitri, *et al.* (2016), exhibited that the LCDS-based interactive ESB produced was effective,

with an average N-gain of 0.69. This indicated that students were more enthusiastic about learning by using this interactive learning model in the material of Sound Waves, resulting in the high average N-gain.

According to these findings, it is discovered that students' responses to LCDS-based interactive ESB are very good, in which students are more interested and enthusiastic in learning and quickly understand the materials learned by using LCDS-based

interactive ESB. Moreover, this interactive e-book improves students to understand more about the phenomena that occur specifically in the materials of the atomic nuclei through animations, simulations and videos. This multimedia produces various events or phenomena in the material of the atomic nuclei, such as the nucleus structure, binding energy of the nucleus, penetrability, rays in the magnetic field, determination of fossil age, types of radioisotopes, radioisotope utilization, nuclear chancellors, and nuclear reactor leaks. Therefore, LCDS-based interactive ESB is an effective strategic media used in the process of learning physics, especially in the material of atomic nuclei.

CONCLUSION AND SUGGESTION

Conclusion

Based on the current findings, it was concluded that: (1) there is an influence of the use of LCDS-based interactive ESB in the material of atomic nuclei on students' HOTS. The average posttest value was 80.7, in comparison of the pretest average of 38.0; (2) there is an effect of the use of LCDS-based interactive ESB in the material of atomic nuclei on students' scientific attitudes. The average scientific attitude of students in the experimental class was 3.53, compared to the control class of 3.40; (3) there is a difference in the average N-gain of HOTS students using LCDS-based interactive and non-interactive ESB. The average N-gain of HOTS students in the experimental class was 0.69, whereas in the control class was 0.63.

Suggestion

With consideration from the findings, authors suggested that: (1) LCDS-based interactive ESB can be

potentially helpful as an alternative learning strategy for those who want to improve HOTS and scientific attitudes of students; (2) this LCDS-based interactive ESB can be a research subject of further studies for those who are inspired to conduct further research with other physical concepts.

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