Multimedia Development Of Science Learning Based On Science Literacy on The Theme of Lightning

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Abstract: This study aims to obtain: (1) multimedia design in science learning on the theme of lightning based on science literacy, (2) student science literacy information after multimedia-assisted science learning on the lightning theme, (3) student response information to multimedia in science learning based on science literacy on the lightning theme. The method used in this study was *Research and Development* with the ADDIE model, while the research design used *pre-experimental pre-test post test only*. The population in this study was grade IX students of one of the junior high schools in Cianjur district for the 2016-2017 academic year with a sample of 31 people determined using the *purposive sample* method. To test the feasibility of multimedia, judgments were carried out by expert lecturers, while students' science literacy data was collected by providing science literacy questions and student responses regarding multimedia were collected through questionnaires given to students. Based on the results of judgments of material experts and lecturers, it shows that aspects of multimedia design quality, aspects of multimedia attractiveness, aspects of multimedia interactiveness and aspects of material conformity with the curriculum are included in the category of excellent. From the results of data processing, it was obtained that students' science literacy abilities had a significant increase in *pre-test* and *post-test scores*. Meanwhile, students' responses to multimedia are very good in the aspect of science literacy content and aspects of potential to increase motivation, while in the aspect of ease of operating multimedia the category is good.

Keywords: Multimedia, Science Literacy, Lightning

INTRODUCTION

According to Toharudin (2010) the weak content of science literacy in science learning at the basic education level is the cause of the lack of success of Indonesian students in TIMSS and PISA. Its main weakness lies in the aspects of scientific attitudes and science competence (Arsyad,

2016). In addition, one of the factors that influence it is that the use of learning media has not been maximized and there are not many media representatives.

One of the learning media that attracts students' interest in learning is multimedia. The use of multimedia can reduce misconceptions and gain meaningful knowledge (Sahin, *et al*, 2010). While

according to Kozma and Russel (in Falvo, 2008), the use of multimedia can explain phenomena at the micro level.

Several studies on multimedia were conducted by Georgio, *et al* (2007), Joshepsen and Kristensen (2006), Tatli and Ayas (2012). From some of these studies, it can be seen that multimedia can help overcome weaknesses in classroom learning, including being able to overcome a condition where an object cannot be witnessed in its actual state because it cannot be sensed.

One of the potential science subject matter delivered using multimedia is the natural phenomenon of lightning. Many people do not know that lightning is beneficial for life and many also become victims of lightning strikes due to ignorance of static electricity matter and its application.

Based on these thoughts, this research will try to solve problems in science learning through the development of multimedia learning based on science literacy on the theme of lightning. The purpose of this study is to obtain multimedia design in science learning on the theme of science literacy-based lightning for junior high school students, to obtain student science literacy information after multimedia-assisted science learning on the lightning theme, and to obtain information on student responses to multimedia in science learning based on science literacy on the lightning theme .

METHOD

This research uses *the Research and Development* method with the aim of obtaining valid and effective multimedia learning. The development model used is the ADDIE design with *the stages of analysis, Design, Development, Implementation* and *Evaluation.*

The steps are as follows: In the Analysis stage (***analysis),*** namely analyzing the need for multimedia development in integrated science learning lightning themes, conducting a standard analysis of content and

subject matter, conducting a literature study, and conducting a preliminary study.

The second stage is ***design,*** which is a multimedia product design based on needs, indicators and goals, creating a storyboard and designing the scenario to be displayed. Furthermore, ***development*** At this stage, the design plan that has been made is realized in the form of finished multimedia and then tested for validation by media expert lecturers and material experts and then revised after input and suggestions from expert lecturers. In addition to validation by expert lecturers, validation was also carried out by fifteen junior high school science teachers who taught at the Cianjur district education office.

Implementation***,*** *),* stage is the stage of using multimedia in the learning process in accordance with what is planned so that at this stage data can be taken on the achievement of student sanis literacy. The instruments used in taking science literacy data are 25 multiple-choice questions as many as 25 science literacy questions consisting of the content domain, the science competency domain and the science attitude domain. To see the effectiveness of multimedia, it is seen from the improvement of students' science literacy skills. The research design used is *pre-test post test design*, so to see data on science literacy ability obtained by comparing pre-test results and post-test results then looking for N-Gain scores. The implementation of the study was carried out at one of the STATE JUNIOR HIGH SCHOOLS in Cianjur district as many as 31 class IX students. In sampling, it is determined using the *purposive sample technique.*

Evaluation is ***the*** final stage of developing the ADDIE design, at this stage it is carried out by providing a questionnaire to students to find out student responses to multimedia that has been used in learning. To produce a valid questionnaire, a CVR was carried out by four lecturers. The resulting data from the questionnaire were processed using the Likert scale rules.

RESULTS AND DISCUSSION

Multimedia Design of Science Literacy-Based Science Learning lightning theme consists of text, images, animation, sound, and video developed based on the science literacy domain contained in the PISA 2015 framework, namely the context domain, content domain, science competency domain, and science attitude domain.

Context Domain

The context domain within the framework of PISA 2015 consists of contextual issues in the personal, national and global sphere. The context contained in multimedia science literacy-based learning on the theme of

lightning includes the context and phenomena of daily life related to lightning in the form of videos and images. Every material that will be discussed in multimedia lightning themes always begins with a contextual phenomenon.

In the multimedia design of science literacy-based learning on the theme of lightning, impressions that belong to the domain of context of the global scope are lightning event videos, lightning hazard videos, images and texts of lightning victims, and the benefits of lightning. Here's one of the impressions on multimedia that belongs to the context domain: The impression in figure 1 is a contextual impression in the form of a video of a lightning event.

Figure 1. Multimedia Design View Science Literacy-Based Learning Domain Lightning Event Context

Figure 2. Multimedia Design View Science Literacy-Based Learning Domain Context Lightning Hazards

Content Domain

The content domain within the framework of PISA 2015 includes important scientific concepts. The content related to multimedia science learning based on science literacy on the theme of lightning is atoms, static electricity, sound, light, ozone reaction equations, and nitrogen cycles. One of the impressions on multimedia that includes the following content domains:

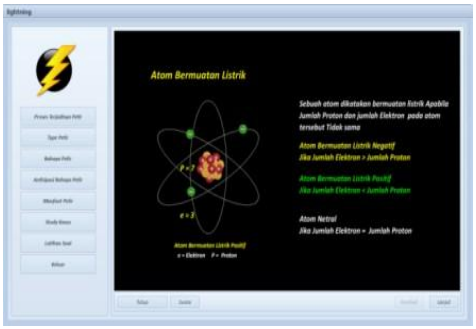

Figure 3. Multimedia Design Display Science Literacy-Based Learning Domain Content Types of Atoms

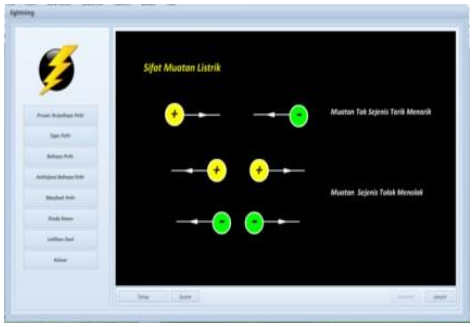

Figure 4. Multimedia Design Display Science Literacy-Based Learning Sifa Content Domain- Electric Charge Properties

Domain of Science Competence

The domain of science competence in the PISA 2015 framework has three competencies, namely competence in explaining scientific phenomena, competence in evaluating and designing scientific research, competence in interpreting data and scientific evidence. The three competencies are contained in the multimedia show of lightning-themed science learning as shown below:

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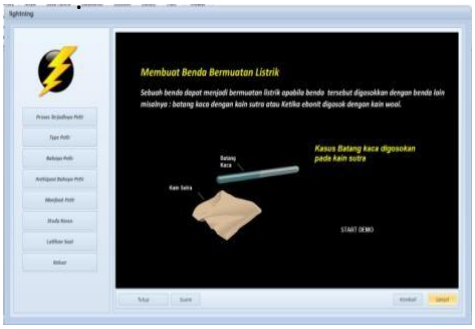

Figure 5. Multimedia Design Display Of Science Literacy-Based Learning Domain Of Competence Explaining scientific phenomena

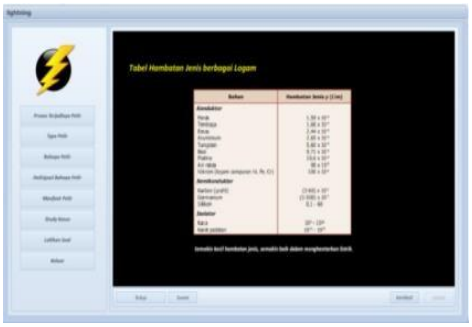

Figure 7. Multimedia Design Display Of Science Literacy-Based Learning Domain Of Competence Explaining scientific phenomena

Figure 6. Multimedia Design Display Of Science Literacy-Based Learning Domain Competencies Interpreting Data and Scientific Evidence

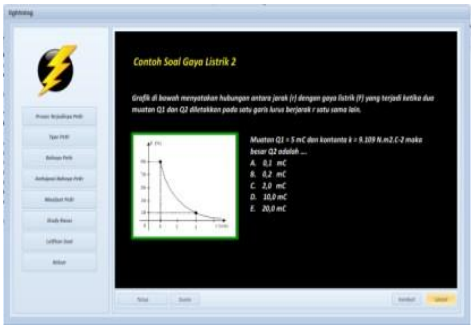

Figure 8. Multimedia Design Display of Science Literacy-Based Learning Scientific Domain Science

The Domain of Attitudes of Science

The domain of science attitudes in multimedia shows of science learning based on science literacy with the theme of lightning aims to increase student awareness when lightning occurs so that it is free from lightning hazards, and furthermore can utilize lightning energy. One of the mitigations to avoid lightning hazards as in the following picture **:**

Figure 9. Multimedia Design Display Science Literacy-Based Learning Domain Science Attitude Avoiding Conductors When Lightning Occurs

Figure 10. Multimedia Design Display Science Literacy-Based Learning Domain Of Science Attitudes If Lightning Occurs In The Car

Multimedia Validation Results

The results of the lightning-themed science literacy-based multimedia assessment by multimedia expert lecturers and material experts are obtained as stated in table 1.

Table 1. Multimedia Validation Results By Experts

No.	Assessed aspects	Validator - % scor					Category
		1	2	3	4	5	
1	Quality of Learning Multimedia Display Design	91,7	86,1	88.9	86,1	83,3	Very well
2	Multimedia Appeal Learning	95	90	90	85	80	Good very
3	Interactive Nature of Multimedia Learning	91,7	91,7	87,5	87,5	75	Very well
4	The Compatibility of Multimedia Learning with the Curriculum	95	95	90	90	70	Very well
5	Content of Science Literacy in Multimedia	89,3	92,3	85,7	89,3	82	Very well

The results of the lightning-themed science literacy-based multimedia assessment conducted by fifteen science teachers are as follows:

Table 2. Multimedia Validation Results By Teachers

NO	Assessed aspects	Average % of score	category
1	Learning objectives in multimedia	92,07	Excellent
2	Science literacy content on multimedia	86,34	Excellent
3	Ease of operation of multimedia	87,1	Excellent
4	The potential of multimedia learning	87,37	Excellent

Multimedia Effectiveness of Science Literacy-Based Learning Lightning Theme Improves Overall Science Literacy

The achievement of overall science literacy can be seen by the increase in *post-test* scores from *pre-test* scores in the form of N-Gain as shown in the following bar chart figure:

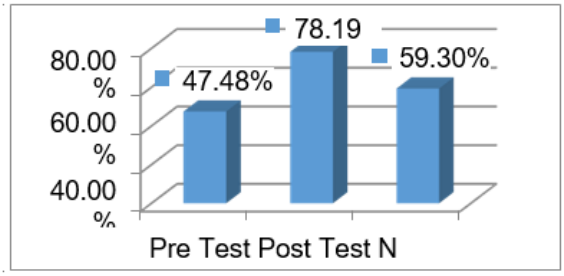

Figure 11. Overall Science Literacy Improvement Graph

Improvement of Science literacy the domain of Science competence

The achievement of science literacy in the domain of science competence consisting of competence to explain scientific phenomena, competence in evaluating and designing scientific research, and competence in interpreting data and scientific evidence as a whole obtained diagrams as follows:

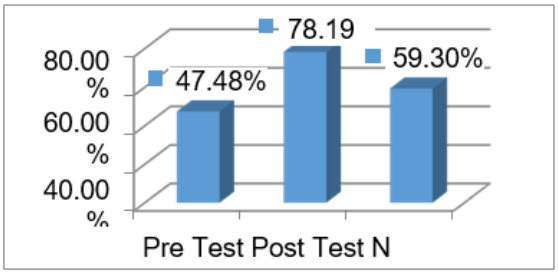

Figure 12. Science Literacy Improvement Graph The Domain of Science Competence

Increased science literacy of content domains

The results of science literacy on the Content Domain are obtained as follows diagram:

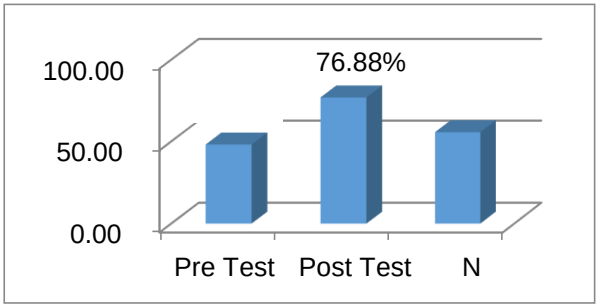

Figure 13.Content Domain Science Literacy Improvement Graph

Improvement of science literacy domain of science attitudes

The results of science literacy of students of the domain of science attitudes are obtained as follows:

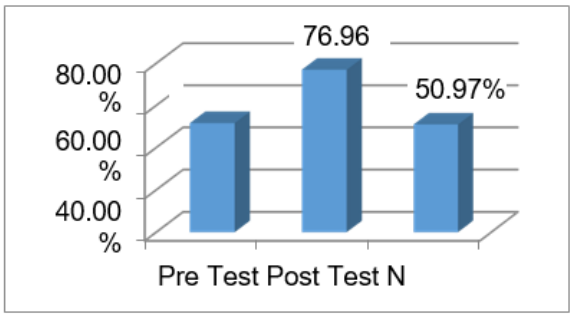

Figure 14. Science Literacy Improvement Graphs The Domain of Science Attitudes

Student Responses to Multimedia

The calculation results obtained from the multimedia response questionnaire given to students are as follows:

Table 3. Results of the questionnaire of student responses to multimedia

NO	Aspects	Score percentage	Category
1	The content of science literacy in multimedia learning	81,9%	Excellent
2	Ease of operation Multimedia	84,9%	Excellent
3	Potential to improve motivation	81,95%	Excellent

Discussion

The multimedia learning developed in this study consists of text, images, animation, video, and sound. The results of the multimedia assessment conducted by material expert lecturers and media experts on the quality aspects of multimedia learning design amounted to 88.9%. According to Arikunto (2010) validation results above 80% are included in the very good category. So the multimedia learning developed in this study on the aspect of design quality is very good, this is because in this multimedia there are instructions for using multimedia that are clearly explained, all navigation buttons are easy to find and function properly. In addition to the navigation buttons using the hurup type, hurup color, hurup size, and balanced hurup layout as well as the language used is simple and understandable, the appearance of the background and attractive media colors make the quality of multimedia design obtain excellent value.

The assessment in the aspect of multimedia attractiveness by expert lecturers obtained a score of 92.5%, including the excellent category. This is because the animations and videos used are attractive, the text and images used are attractive, the appearance and layout of the media are attractive, and the color composition of the display used is attractive. The assessment results in the aspect of multimedia interactiveness of learning obtained a score of 91.7%, including the excellent category. This is due to the more interactive nature of multimedia supported by the ease of use of navigation buttons, clarity of linking buttons to other pages , ease of material structure that is easy to understand, questions in multimedia help shape the framework of student thinking. In addition to the form of evaluation
provide feedback that demonstrates students' understanding.

In the aspect of conformity with the curriculum obtained a score of 95% including the category of excellent. This is because in the multimedia

developed there is a conformity of basic competencies with indicators, systematics of presenting material to achieve concurrent competencies, compatibility of the scope of the material with basic competencies and indicators, there is a conformity between the context displayed and the content, there is a compatibility between images, animations, tables and videos displayed on multimedia with content / material.

Meanwhile, the results of the multimedia learning assessment on the aspect of science literacy content of 90.8%, including the very high category, are caused by the multimedia developed in this research based on science literacy contained in the PISA 2015 framework, namely the existence of content domains, science competencies, and science attitudes displayed by context. In addition, the compatibility between the images, animations, and videos displayed is adjusted to the domain of science literacy .

The multimedia assessment carried out by science teachers on the aspect of learning objectives obtained a score of 92.07%, including the excellent category because in the multimedia developed in this study the learning objectives were conveyed clearly, the learning objectives were in accordance with KI and KD, the material presented was in accordance with the learning objectives, the objectives were directed to improve mastery of concepts.

The results of multimedia assessment by teachers in the aspect of science literacy content on multimedia learning of 86.34% are included in the excellent category. This is because this multimedia learning contains the phenomenon of daily life in the science material with the theme of lightning, has the potential to increase student mastery of concepts, has the potential to increase student competence in explaining scientific phenomena, evaluates and designs scientific research, interprets scientific data and evidence, and has the potential to improve students' scientific attitudes.

The assessment in the aspect of ease of operating multimedia learning 87.1% belongs to the excellent category. This is because the multimedia developed is equipped with navigation buttons that function well and are easy to use, so students will not have any difficulties if they use them independently without the guidance of the teacher.

The results of the assessment in the aspect of multimedia learning potential obtained a score of 87.37% including the very high category. This is because multimedia based on science literacy with the theme of lightning can facilitate student learning modalities (visual, auditorial, kinesthetic), can support science learning lightning theme, especially used for main learning, as well as enrichment and remedial. In addition, the multimedia developed has the potential to increase student learning motivation, and serves to improve the mastery of concepts.

The results of the overall analysis obtained N-Gain of 59.3%, indicating that the effectiveness of multimedia learning based on science literacy as a whole is categorized as moderate. This is due to the increase in science literacy in the domain of science knowledge and the attitude of science at a moderate level. The results of this study are in line with the results of the study (Latif, 2015), namely the use of multimedia in learning can increase students' science literacy at a moderate level. Another research on the use of multimedia conducted by Bahriah (2012) stated that students' science literacy increased after learning by using interactive multimedia software in chemical equilibrium materials, as well as Retmana (2010) which stated that interactive multimedia-based learning improves students' science literacy skills on materials using chemicals in food to human digestion. In addition to improving science literacy, it turns out that multimedia learning can also increase student learning achievement (Aisyah, 2013). But this is not in line with the results of Arisman's (2015) research that states that in STAD-type cooperative learning with the practicum method, it can improve science literacy better than in increasing science literacy in classes that use interactive multimedia demonstrations.

For multimedia effectiveness, judging from the domain of science competence, an N-Gain value of 71.77% was obtained with a high category. This is in line with Latif's research (2015) which states that the use of multimedia can improve the domain of science competence in the high category. This is in accordance with the results of Oktarisa's research (2016) that multimedia-assisted experience-based learning models can improve mastery of science concepts and competencies better than conventional learning models. As for the domain of science knowledge, an N-Gain value of 55.63% was obtained, which is categorized as moderate. This is in accordance with Latif's research (2016) which states that the use of interactive multimedia in learning can improve students' science literacy at a moderate level of knowledge. The results of knowledge domain science literacy have not reached the high category because according to Yen Chang (2002) that the teaching approach using teacher-centered multimedia is more effective than teaching using student-centered multimedia, especially at the level of knowledge and application of the cognitive domain. The last is the aspect of science attitudes owned by students with an N-Gain score of 50.97% stating that the multimedia effectiveness of science literacy-based learning is effective in the moderate category. This is in line with his research Osma (2007) that instilling a positive scientific attitude is important to promote more effective science learning.

The results of the questionnaire calculation obtained that the content of science literacy in multimedia learning was very good with a score of 81.9%. This is because multimedia learning lightning theme can help

students in understanding scientific phenomena in daily life, can design scientific research, can determine students' attitudes in anticipating lightning hazards.

Science literacy-based multimedia has the potential to increase student motivation in the learning process very well with a score of 81.9%. This is because in multimedia the theme of lightning based on science literacy is more interesting than ordinary learning, so students feel happy in learning lightning. In addition, multimedia learning lightning themes have more challenges than ordinary learning. These results are in line with his and Supianto's research (2014) that almost all students are motivated to learn with the multimedia used, can control multimedia learning well, and provide good responses to multimedia

Meanwhile, in terms of ease of operation, multimedia is at a very good stage with a score of 84.9%. This is because in science-based multimedia the lightning theme is easy to operate, animations and images are easy to understand, navigation buttons can be used well. These results are in line with the results of his research Melvi (2006) that the use of multimedia can increase student interest and make the presentation of material more interesting

COVER

Multimedia science learning based on science literacy on the theme of lightning is displayed in the form of text, images, animations, disseminations and videos that are based on the PISA 2015 framework, namely the domain of content, science competence and science attitudes. All material presented always begins with a context related to lightning, so that students can better understand the content to improve science competence and science attitudes. This can be seen from the results of *the pre-test* and *post-test* of students' science literacy ability, the results of which turned out to be an increase of 59.30% (moderate category) overall. While the increase in the content domain was 55.63% (medium category), for the science competency domain there was an increase of 71.77% (high category), and for science attitudes there was an increase of 50.97% (medium category)

When viewed from the results of increasing science literacy, students who got a high category were only the domain of science competence, the others only got the medium category. Therefore, multimedia learning based on Science Literacy on the theme of lightning still has a lot to be completed and improved, especially in the domain of science attitudes.

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