Development of Light and Optics Learning Multimedia Oriented Students Creative Thinking Skill

Pajrina Auliyak*, Dwi Wiwik Ernawati & Wilda Syahri
Magister of Science Education, University of Jambi, Indonesia
*Corresponding Author: pajrinaauliya@gmail.com

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Abstract **-** The purpose of this research is to develop learning multimedia on light materials and optic tools oriented to students' creative thinking skills that can be used in the learning process either online or offline. This development research uses the Hanaffin and Peck development model. Data was collected using a questionnaire instrument and pretest-posttest questions on creative thinking to 19 students at MTsS Nurul Islam Batang Hari. The results of expert validation show that the learning multimedia developed is feasible to be used in the learning process at the trial stage. The teacher's and student's responses to the multimedia being studied are very good to use. The test results show that the multimedia developed is very good and feasible. Meanwhile, students' creative thinking skills have increased with an N-Gain value of 0.84, which is in the high category. It means that the effective multimedia developed can improve students' creative thinking skills. Further research is expected to develop this learning multimedia on other materials oriented to creative thinking or 21st-century skills.

Keywords*: Multimedia; Learning; Light and Optics; Creative Thinking*

INTRODUCTION

21st-century competencies, according to Soland et al., (2013), include being able to apply information and communication technology (information of communication technology literacy skills), critical thinking skills (critical thinking skills), problem-solving skills (problem-solving skills) (Wahyuni et al., 2017), skills communicate effectively (practical communication skills), and collaboration skills (collaborate skills) (Chaeruman, 2010). The standards needed for students to have the competencies needed in the 21st century, namely the mastery of creative thinking skills, flexible problem-solving, collaboration, and innovation that students must have (Hakim et al., 2017; Dewi et al.,2019). Therefore, the need for students' creative thinking skills in the learning process in order to achieve the desired 21st-century competencies. Moon (2008) also expressed his opinion that one of the skills that students must possess is creative thinking skills.

Creative thinking skills are the ability to develop new ideas and find new ways of solving problems and opportunities (Mulyadi & Wahyuni, 2016; Marnita & Ernawati, 2017). The importance of creative thinking skills in each student is developed so that students are more skilled in formulating an opinion or argument and deciding in the problem-solving process (Sulistiani & Masrukan, 2017). According to Hadzigeorgiou et al., (2012), creative thinking skills are the basis of science. Therefore, creative thinking skills need to be trained through learning, especially in science learning. to overcome this, we need a media that can help in the learning process, even better if it is multimedia (Gunawan et al., 2016).

Multimedia combines one form of media with other media, such as text (in the form of letters and numbers), symbols, images, audio, video, and animation, which are usually assisted by technology to support understanding and reminders (Guan et al, 2018). Multimedia can also be interpreted as

any presentation, including verbal and visual information (Mayer, 2001). To motivate students to analyze, creating the knowledge they have. Multimedia can be used as a tool and motivation for them in this regard (Wahyudin et al., 2010; Santhalia & Sampebatu, 2020). Andresen & van den Brink (2002) argue that multimedia is also considered a means of communication and a learning tool. In the learning process, multimedia can be used online as an effective way to develop abstract discussion topics.

In addition to the survey results, the researchers interviewed an MTs Nurul Islam Batang Hari science teacher. The results of the interview stated that the lack of learning media used in the learning process in class and the impact of the Covid-19 outbreak caused a lack of student learning potential and creative thinking skills students, so the learning objectives need to follow what is desired. Therefore, with supporting media in the form of learning multimedia, students can use in learning only Android/smartphone tools. It is hoped that it will overcome students' obstacles in obtaining learning and facilitate students in independent learning so that students can learn anywhere and anytime, especially in science learning on light and optics. Therefore, this development research was carried out to develop teaching materials in multimedia learning light and optics oriented to engage students' creative thinking skills. The difference between this and other multimedia is that this media is designed to refer to students' creative thinking skills applied to light and optical devices.

The multimedia developed is an application that students can access via Android and can be used offline or online. With this application, students can not only learn in class but can learn anywhere and anytime.

RESEARCH METHODS

The research method uses the type of Development research with the Hannafin and Peck development model consisting of 3 stages, namely the needs analysis stage, the design and the development and implementation stage (Hannafin & Peck, 1988). the research method is very relevant to what the researcher will examine, because the Hannafin and Peck model focuses on technology-based product developers. This Method relevant Hanaffin & Peck's model can be seen in the following Image.

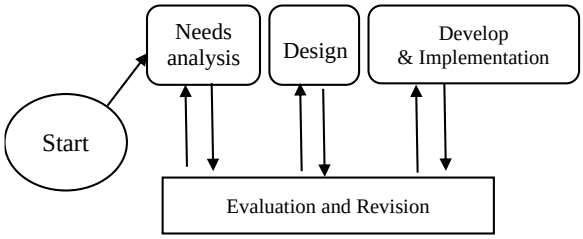

Figure 1. Hannafin & Peck development model (Hannafin & Peck, 1988)

The data collection instruments used were interview sheets, student needs questionnaires, media and material validation questionnaires, teacher response questionnaires and student responses and pretest-posttest questions. The questionnaire in this study was assessed using a Likert scale with a scale of 1-5. Meanwhile, the pretest-posttest questions consist of 10 description questions at the C4-C6 cognitive level of Anderson's Taxonomy.

Analysis of the data obtained from the validation, teacher assessment and student responses then calculated the average percentage and analyzed using the available criteria. The formula used to calculate the percentage of each questionnaire is as follows.

To determine the effectiveness of the developed Multimedia, we conducted a pretest-posttest during large-scale trials carried out before and after the learning process using the product being developed. In order to be able to determine the value of

students' pretest and posttest, this trial uses the one-group pretest-posttest design.

After getting the pretest and posttest scores, the N-Gain or gain normality test was carried out to see an overview of the increase in the result score before and after treatment (Hake, 1999). So, in this test, we can see an increase in the treatment given to developing the developed multimedia product.

As for determining the results of N-Gain on the data, namely:

$$N - gain\ (g) = \frac{posttest\ score - pretest\ score}{maximum\ score - pretets\ score} \quad (1)$$

To see the N-gain category obtained, that is by using the interpretation of the normalized gain index (g) according to Hake, which has been modified. That can be seen in Table 1 below.

Table 1. Gain Category

N-gain Score	Interpretation
g > 0,7	High
0,3 < g <0,7	Middle
g < 0,30	Low

(Hake,1999)

RESULTS AND DISCUSSION

The results of development learning multimedia on light and optics oriented creative thinking skill students of MTsS Nurul Islam.

Results

Needs Assessment: At the needs assessment stage, an analysis of multimedia media needs is carried out to help students in the learning process. The needs analysis resulted in the need for multimedia learning that can help students who can assist students in learning both online and offline, especially during the Covid-19 pandemic, where students learn remotely using android/mobile phones. The learning multimedia developed is an application that can be installed on each student's android so that students can not only study in class but also at home or anywhere. Based on the analysis, 90% of students are more interested in learning by using android, and almost 95% have this tool. This multimedia benefits students and teachers so that the learning media used are varied, and students will feel energized in participating in learning (Listyawati, 2012).

Design: at the design stage, the researcher designed the initial learning multimedia product in the form of a Storyboard which became a guide and reference for researchers in making multimedia that would be developed.

Development and Implementation: in this stage, the multimedia developed is made using Adobe Flash Professional CS 6 software with a multimedia display, as shown in Figure 2 and 3 below.

Figure 2. Login Menu

Figure 3. Home Menu

After the multimedia has been made, it is then validated by material experts and media experts to see the appearance and suitability of the material with the concepts

and principles of light and optical devices. Material validation includes suitability with competence, suitability with learning objectives, presentation of material and suitability of material with aspects of creative thinking. Media validation includes aspects of coherence, signaling, redundancy, spatial contiguity, temporal contiguity, segmenting, pre-training, modality, personalization, sound, multimedia, image, practical and efficient. The results of the media validation are in Table 2.

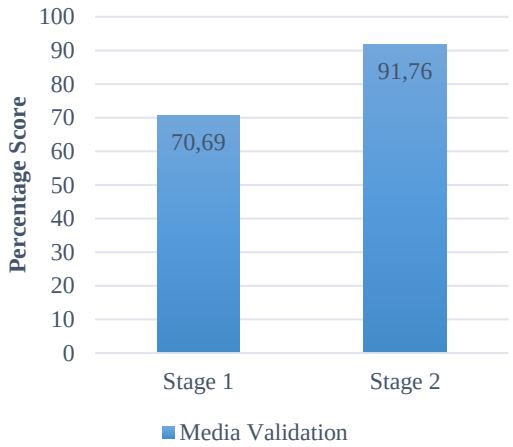

Figure 4. Result of Media Validation

After the multimedia has been made, it is then validated by material experts and media experts to see the appearance and suitability of the material with the concepts and principles of light and optical devices. Material validation includes suitability with competence, suitability with learning objectives, presentation of material and suitability of material with aspects of creative thinking. Media validation includes aspects of coherence, signaling, redundancy, and spatial. Figure 4 shows that the total average score of the media validation percentage in stage 1 is 70.96% and is in the feasible category. Then it was revised by the researchers, and another stage 2 validation was carried out with the percentage obtained, namely 91.6%, which was in the very feasible category. It shows that the developed learning multimedia is valid and feasible for students to use and try out.

In material validation, the results of media validation can be seen in Figure 5 below.

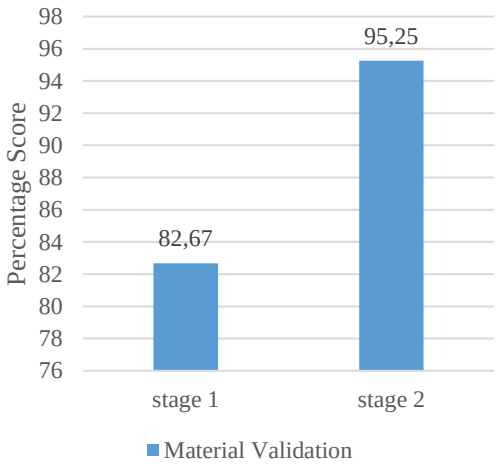

Figure 5. Result of Material Validation

Figure 5 shows that the total score of the average percentage of material validation in stage 1 is 82.67% and is in the proper category. Then it was revised by the researcher, and another stage 2 validation was carried out with the percentage obtained, which was 95.25% in the very feasible category. It shows that the developed learning multimedia is valid and feasible for students to use and try out.

After being validated by media and material experts, it was declared feasible to be tested. Then the product was assessed by the Science Subject teacher to see how the teacher's response to the developed learning multimedia. From the teacher's assessment, the product received a very appropriate response from the teacher concerned about the developed multimedia. It is evidenced in the results of the teacher's assessment of learning multimedia in Table 2.

Based on the teacher's response in Table 4, the average percentage of product assessment is 90.4%. The teacher states that the product is very suitable for use and tested on students; besides, the teacher also states

that the material in the Learning Multimedia is displayed interestingly and can be understood by participants students. Coupled with the use of video, which is good enough for the material to increase students' skills in creative thinking. And the rest of the time, the teacher invites students to do small group trials.

Table 2. Result of Teachers Assessments

Aspect	Persentage(%)	Category
Appearance	92	Very valid
Content	90	Very valid
media efficiency	80	Valid
benefit	95	Very valid
Creative thinking	95	Very valid
Mean	90,4%	Very valid

After the product received a response from the teacher that the product was very feasible to use, a small-scale buckwheat test was carried out on students to find out how students responded to the multimedia product being developed. The results of student responses can be seen in Table 3 below.

Table 3. Result of Students Responses

Aspect	Persentage(%)	Category
Appearance	84,88	Very good
Content	91,66	Very good
Media efficiency	93	Very good
Benefit	93	Very good
Keterampilan berpikir kreatif	88,88	Very good
Rata-rata	90,42%	Very good

Table 3 shows that students' responses are obtained with an average percentage of 90.42% in the very good category. It shows that students are very responsive to the use of new learning multimedia, and according to students, this type of multimedia has never been used during the learning process. Students are very enthusiastic about using multimedia. The same thing in previous studies received very practical responses from students (Santhalia, 2020). The practicality obtained shows that multimedia is very well used and is more flexible.

To determine how the effectiveness of multimedia learning is shown in the pretest and posttest scores on large-scale trials and the results of the N-Gain test. The students' pretest and posttest results have increased, and the N-Gain test is at a high level which can be seen in Table 4 below.

Table 4. Score of Pretest and Posttest

Test	Pretest	Posttest	N-Gain
N	19	19	
Total score	16,2	50,8	
Rata-rata	8,57	26,74	0,84
Maximum score	13	30	
Minimum score	4	23	

Based on the statement that has been described, the multimedia learning light and optical tools oriented to students' creative thinking that is developed are very feasible and very effective for use in the learning process.

Discussion

The table and figure in the results section show that multimedia development gets a high score from material and media validation. From the first validation by media experts in Figure 3, it is obtained that a percentage of 70.96% is included in the feasible category with several revisions. After being revised based on the first validation suggestion, a second validation was carried out and obtained a percentage of 91.6% in the "very feasible" category. Without revision. The score on the second validation is better than the score on the first, so the media expert validation states that the Multimedia Learning of light and optical

tools oriented to students' creative thinking skills is feasible and is welcome to be tested.

After that, validation was carried out by material experts in Figure 4 and obtained a percentage of 82.67% included in the feasible category with several revisions. After being revised based on the first validation suggestions, a second validation was carried out, and the percentage of 92.25% was in the "very feasible" category. Without revision. The score on the second validation is better than the score on the first validation, so the material expert validation states that the Multimedia Learning of light and optical tools oriented to students' creative thinking skills is feasible and is welcome to be tested.

After the media and material experts stated that the product was feasible, this learning multimedia was assessed by the science subject teacher at school. Based on the teacher assessment questionnaire results, a percentage of 90.4% was obtained in the "very decent" category.

At the implementation stage, a small-scale product trial in class IX consisted of 3 students who were taken based on various levels of competence, namely high, medium and low, to determine student responses regarding the developed learning multimedia product. Based on the small group trial calculations, the percentage obtained was 90.42%, with the student response criteria being "very good". In the small group trial, the researchers needed to learn how effective the use of multimedia for learning light and optical devices was for students' creative thinking skills. Therefore, researchers conducted large group trials to determine the effectiveness of the products developed.

After conducting small group trials and obtaining excellent results, the researchers conducted large group trials to see the effectiveness of the product being developed. Small group trials were carried out for class VIII, who had yet to study light and optical instruments. This large group trial used the One Group Pretest-Posttest Design. This design was tested on one group that did the pretest and post-test. After the trials, the total pretest scores were 16.52, and the results of the total post-test scores were 50.8. Based on the total score, the post-test results were higher than the pretest results obtained by students, and the products developed were effective for use.

After the pretest and post-test were carried out to get more accurate results, the researcher conducted the N-Gain test to see how much improvement was obtained in the pretest and post-test. So, the results of the N-Gain test were obtained, equal to 0.84, with the increased category being high.

This research produced multimedia learning products for light and optical devices oriented toward students' creative thinking skills. Products are designed to stimulate students' creative thinking skills—evidenced by the excellent product assessment by validation experts, teacher responses, and student responses. In addition, the effectiveness of using learning multimedia was obtained through pretest and post-test with high improvement results.

According to Okta et al. (2020), learning multimedia can streamline student study time, motivate students to learn, train student curiosity and independence, and match good character for student personalities. Based on this statement, multimedia can also help students learn independently and foster students' curiosity so that students' creative thinking skills can be improved and trained. It is because multimedia consists of various combinations of media placed in one component, such as an application, so that students not only see or understand the material in words alone but

through images, sound, audio, video, and animation in one multimedia component.

CONCLUSION

This research produced a Light and Optical Learning Multimedia oriented towards students' creative thinking abilities with validation results in the "very feasible" category. With a percentage of material validation of 96.25%, media validation of 91.54%, teacher responses were very appropriate with a percentage of 90.4%, and student responses were very good with a percentage of 90.42%. Multimedia is very effectively used in learning because of an increase in the N-Gain test of 0.84 in the high category. The author suggests to future researchers to be able to continue this research to the experimental or class action stage.

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