Phys. Comm. 8 (2) 2024 : 60 - 65

Physics Communication

http://journal.unnes.ac.id/nju/index.php/pc

Development of Learning Media Based on Smart Apps Creator to Improve Student's Critical Thinking Skills

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Article Info

Article history:
Submitted 2 May 2024
Revised 10 August 2024
Accepted 12 August 2024

Keywords:
Learning Media, Smart Apps Creator, Critical Thinking Skills

Abstract

Students have difficulty understanding abstract physics concepts because they are difficult to visualize. Based on the results of observations, students' critical thinking skills are not yet improved and the learning process is still conventional. The use of learning media based on Smart Apps Creator by integrating the PBL learning model aims to improve student's critical thinking skills. Based on the developing of ADDIE model, this study is development research or Research and Development (R&D). During the 2022–2023 academic year, class XI–3 students at SMA Negeri 1 Kembang were the subjects of this study. The validation results by material experts were 88.75% and media experts were 89.38% in the very feasible category. Learning media based on Smart Apps Creator (SAC) is effective to improve student's critical thinking skills as shown by the higher percentage of N-Gain test results for the experimental class, namely 76.82% with effective criteria, compared to the control class of 56.46% with quite effective criteria. Analysis of the profile student's critical thinking skills after the action was shown by observation results of 84.52%. This shows that students in this class can improve their critical thinking skills.

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p-ISSN 2528-5971
e-ISSN 2528-598X

INTRODUCTION

Students need to be able to master 21st century skills. Critical thinking skills can improve student's analytical skills and influence their intellectual skills. Physics subject matter has abstract and concrete characteristics. Students have difficulty understanding abstract physics concepts because they are difficult to visualize. In this situation students will consider Physics material to be boring and difficult. The abstract content of Physics subject matter makes students difficult to learn Physics concepts unless they are connected to everyday experiences.

Meanwhile, according to Greca & De Ataíde (2017), learning media is a tool for resolving abstract material characteristic problems because solving physics problems or understanding physics concepts is not enough with technical knowledge of mathematics. According to Wahyuningtyas (2020) if society has now changed to a digital society, then teachers must also immediately adapt technically and socio-culturally to get used to the digital world. If this is cultivated it can improve teacher's quality and creativity. The competence of teachers must be prepared by strengthening cyber pedagogy in the digital learning era. Teachers are more as facilitators and can produce meaningful, creative and enjoyable learning using digital technology.

Based on the observations, students view teachers as the most important learning source in the learning process. Students who did not complete the minimum score were greater than who were able to complete the minimum score. This situation shows that student's critical thinking skills are still low. The development of learning media by integrating the PBL learning model and based on Smart Apps Creator media aims to face the challenges of 21st-century learning. Based on the background that has been written, this study use Smart Apps Creator to create learning materials that contain images, simulations, videos and interactive questions to improve student's critical thinking skills.

Sekolah Menengah Atas Negeri (SMA N) 1 Kembang is one of the state senior high schools that implements *Kurikulum Merdeka*. However, interviews with class XI students stated that Physics is difficult to understand because there are many complicated formulas and calculations. The results of class observations, when the teacher allowed students to ask questions about material they did not understand, none of the students asked question. Besides that, students seem have difficulty to make opinions and conclusions. This is seen when the teacher assigns one of the students to complete the topic being discussed because students cannot explain the topic being discussed. When the teacher sets a problem, students still can't determine the equation to solve the problem.

Critical thinking is one of the skills that need to be developed, especially as part of the educational process to face future difficulties. Facione (2011) defines critical thinking as the way humans make decisions, interpret, analyze, evaluate and make conclusions and use evidence, concepts, criteria, or contextual considerations as the basis for decision making. Facione in Hidayah et al. (2017) divides critical thinking skills into interpretation, analysis, inference, evaluation, explanation, and self-regulation. (1) Interpretation is the ability to understand and explain situations, information and messages received. (2) Analysis involves detailed observations and descriptions of information obtained for further study. (3) Inference is the ability to draw conclusions based on evidence. (4) Evaluation includes assessment by measurement or comparison. (5) Explanation is the ability to explain processes, information and phenomena. (6) Self-regulation means having the ability to regulate oneself, for example by observing what happens in one's cognitive environment and the elements used to achieve results, including the application of analytical and evaluative abilities in one's own judgment. Student's critical thinking skills can be improved through structured group discussions and guided directly by the teacher. Indicators of critical thinking skills in Abdurrahman et al. (2019) suggested by: Ennis (1985) and contain basic clarification, basic support, conclusions, clarification progress, strategies and tactics.

A learning model is a plan or template that functions as a guide for planning the learning process. According to Islamiah et al. (2018), the PBL learning model is learning that begins with a problem which is used as a means of inquiry by students. The problems presented at the beginning of learning are authentic and meaningful. Each student or group must complete these tasks individually. Students aim to gain more meaningful knowledge by trying to solve problems independently. The PBL learning steps used include: 1) presenting the problem, 2) organizing students to learn, 3) assisting with independent and group investigations, 4) developing and presenting the results of the work, and 5) analyzing and evaluating the problem solving process (Windari & Yanti, 2021).

Then Martín-Blas & Serrano-Fernández (2009) the use of multimedia devices can make activities interesting so that the learning process is more student-friendly and increases student's interest in learning Physics. Teachers can provide students with many resources that often cannot be presented in class due to time limitations. Smart Apps Creator (SAC) is an application that helps learning using Android and iOS devices without requiring programming code. This application consists of animations, images, videos, music and other menus. The appearance of the application is very simple so students can easily accept it. The

visualization is a combination of e-book and PowerPoint. The learning media developed in physics subjects is in the form of mobile apps and mobile quiz apps to increase student's learning motivation.

The characteristics of learning media that make it different from other teaching materials are: (a) Can present completely various forms of images, animation, audio and video; (b) Students can learn independently by studying the material in learning media in flexible time and space; (c) All learning materials are presented in their entirety as a complete unit; (d) Increasing the effectiveness of learning; (e) Providing additional information that is easier and more complete via internet access. Elfeky & Masadeh (2016) students' understanding of the learning material provided through mobile learning is much better than understanding of the same material using traditional learning methods, namely face-to-face learning.

METHODS

The research design uses a Research and Development (R&D) design. The R&D model aims to make a product, this research produces an educational product namely electronic learning media in the form of Smart Apps Creator, which is then tested for feasibility. The basis for developing learning media follow to the ADDIE model. "The ADDIE development model can be used to design learning systems to be effective and efficient. The ADDIE development model is simple and can be implemented in stages or systematically to create a complete learning system. ADDIE is an acronym for Analysis, Design, Development, Implementation and Evaluation" (Putra et al., 2020).

According to Hake (2002) the effectiveness of learning media is measured by increasing student's critical thinking skills before and after learning activities using learning media based on SAC, calculated using the n-gain test with the following formulation:

$$\langle g \rangle = \frac{\%\ Gain}{\%Gain_{max}}$$

$$\langle g \rangle = \frac{(\%\langle posttest \rangle - \%\langle pretest \rangle)}{(100 - \%\langle pretest \rangle)}$$

RESULTS AND DISCUSSION

The development of learning media based on Smart Apps Creator (SAC) implemented in this research aims to create learning media to use in the learning process. Meanwhile, the use of developed physics learning media can improve students' critical. Characteristics have the meaning of unique characteristics according to certain characteristics, the learning media developed by researchers also have certain characteristics that are different from other learning media. Several characteristics of the learning media are interactive, in *html* form, user friendly, self-instruction and independent. The response dialogue from input and output, such as when the user enters a command, the system immediately responds to this condition, shows that the learning media is interactive. The interactive characteristic of the learning media allows for reactions from the media to user commands. Several things that show the interactive characteristics of this learning media are described in Table 1.

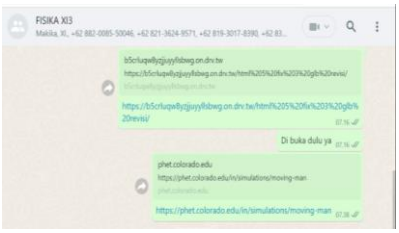
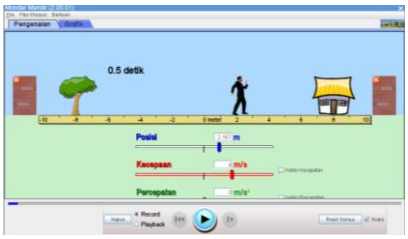
The learning media format developed in this research is a hypertext markup language (HTML). Based on research results by Hochberg et al. (2018) it was concluded that the use of smartphones as an experimental tool significantly increased student's interest in physics classes and curiosity about the content of the experiments. Likewise, research results in Hochberg et al. (2020) show that using smartphones as experimental tools can significantly increase student learning achievement.

Validation of learning media designs includes validation by material experts and validation by media experts. Each validator is by a lecturer and a teacher who has expertise in that field. Based on the validation results from material experts, an average percentage of 88.75% was obtained for very feasible criteria. Based on the validation results from media experts, an average percentage of 89.38% was obtained for the very feasible criteria. The results of trials using physics learning media using SAC on a small scale showed a percentage of 85.00% with the criteria being very suitable for use. The feasibility trial was carried out in class XI-2 which consisted of 36 students. The results of student assessments regarding the use of physics learning media using SAC show that the learning media is appropriate with a percentage of 93.33%. The response of physics teachers as users to the use of physics learning media using SAC showed a percentage of 85.00% with very feasible criteria.

The implementation of learning media based on Smart Apps Creator (SAC) was carried out in physics learning activities in class XI-3 SMA Negeri 1 Kembang for the 2023/2024 academic year to improve student's critical thinking skills. Physics learning media based on SAC is prepared and designed to support the physics learning process with the PBL learning model. Learning activities using physics learning media based on SAC begin with an introduction to learning media, accessing learning media links on Android/iPhone devices

and using learning media in learning activities. Each student accesses the learning media link on their Android/iPhone device and is ready to take part in learning activities.

Table 1. Interactive Properties of Physics Learning Media using Smart Apps Creator

Interactive	Display
Users can immediately open learning media by the link sent via WhatsApp	
Users can select menus on the menu page	
Users can set when to play or turn off videos on learning media	
Users can simulate the learning material they are studying	
There are practice questions in the form of interactive quizzes that respond to the user's answer choices	

Aspects of student's critical thinking skills are the main focus of this research. Assessment of student's critical thinking skills is carried out through pre-tests, post-tests and observations during learning activities. The effectiveness of the physics learning media based on SAC used in learning to improve critical thinking skills is measured based on the n-Gain of the pretest and posttest results of the experimental and control classes, which is used to determine the magnitude of the increase in student's critical thinking skills. The experimental class uses physics learning media based on SAC and the control class uses the lecture learning method. The results of the assessment of student's critical thinking skills in the pretest and posttest are shown in Table 2.

Table 2. N-Gain Test Results

Class	Percentage	Criteria
Experiment	76.82%	Effective
Control	56.46%	Quite Effective

Based on Table 2, it can be seen that the n-Gain percentage of critical thinking skills of experimental class students is greater, namely 76.82% with effective criteria, while in the control class, it is 56.46% with quite effective criteria. Based on the table of N-Gain test results, it can be seen that the application of physics learning media based on SAC in experimental classes is effective to improve student's critical thinking skills. Meanwhile, the application of learning media using the lecture method in the control class is quite effective to improve student's critical thinking skills.

The application of physics learning media based on SAC to improve students' critical thinking skills is declared effective because the use of media can attract students' interest in learning to focus on the learning process. Apart from that, the PBL learning steps are by the indicators of student's critical thinking skills used. The first aspect of critical thinking is basic clarification by the PBL learning steps of presenting problems and organizing students to learn. At this stage, students are conditioned to participate in learning by providing a basic explanation of the problems presented.

Critical thinking aspects of interpretation, analysis, evaluation and inference by PBL learning steps help independent and group investigations. At this stage, students are conditioned to carry out experiments through simulations together with their group and create experimental hypotheses, then process the data obtained and discuss to analyze the experimental data and draw conclusions. The next aspect of critical thinking is explanation according to the PBL learning steps of developing and presenting the results of the work. At this stage, students are conditioned to present the results of discussions with their group in front of other groups.

The final aspect of critical thinking is self-regulation by the PBL learning steps of analyzing and evaluating the problem solving process. At this stage, the students together with the teacher conclude the results of the experiments that have been carried out. Apart from that, the teacher also confirmed that the concepts were not suitable. Aspects of critical thinking that are suitable to the learning steps used, assisted by the use of suitable learning media, can improve student's critical thinking skills.

Analysis of the profile of student's critical thinking skills after the action by observations during learning activities. Researchers are assisted by observers who are tasked with observing aspects of student's critical thinking skills during the learning process. The results of these observations show that the average of all indicators of student's critical thinking skills in this class is 84.52%. The highest percentage was found in the first aspect, namely basic clarification in the form of providing a basic explanation. There were 91.67% of students able to provide a basic explanation according to the concept correctly. This shows that students in this class can improve their critical thinking skills.

CONCLUSION

The developed physics learning media has several characteristics, i.e in *html* form, being interactive, user-friendly, self-instruction and support independent learning. This media based on SAC for improving high school students' critical thinking skills is very suitable for use in learning activities, shown by 88.75% material expert validation and 89.38% media expert validation. The student responses with a percentage of 85.00% in small-scale trials and 93.33% in trials of use in learning activities, supported by teacher responses which reached a percentage of 85.00%.

Physics learning media based on SAC is effective to improve the critical thinking skills of students at SMA Negeri 1 Kembang. This is shown by the higher percentage of N-Gain test results for critical thinking skills of experimental class students, namely 76.82% with effective criteria, compared to the control class of 56.46% with quite effective criteria. Students' critical thinking skills profile after the action in average 84.52% and reach the highest percentage (91.67%) in the first aspect, i.e basic clarification to present a basic explanation. This shows that students in this class can improve their critical thinking skills.

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