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Development Media Teaching of Physics by LMS Moodle with Modellus to Improve Students' Analysis Ability

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Abstract

This development media teaching of physics by Moodle basic Modellus with wave equation material aimed to improve the student's ability in analysis. In this research, the researcher developed ADDIE models: analysis, design, development, implementation, and evaluation. The research took place in SMA Negeri 1 Petanahan Kebumen with the subject researcher with limited testing to five students and, in the Implementation step eighteen students. The data analysis the researcher used is a validation sheet, questionnaire, observation technique, and the result of students' tests. Based on the research, we can conclude that: (1) the validation result from the expert validator is 3.10, from the material expert is 3.27, from the media expert gained a good category, which means valid, 2) the media physics learning process LMS Moodle basic Modellus practical because it works in limited trials and great trials, and received a positive response, and 3) the analysis test result there is an increase learning progress with N-gain as 0.70, it means high category and its effective. Similarly, learning physics by LMS Moodle with Modellus on this researcher is valid, practical, and effective. Furthermore, it works to improve the student's ability in analysis.

Keywords: Analysis Skill; LMS Moodle; Media; Modellus

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INTRODUCTION

The 21st-century learning model emphasizes students' ability to think critically, connect science with the real global, master information technology, as well as communicate and collaborate. Critical thinking skills, or what is called high-order thinking skills (HOTS), are skills that need to be mastered. In steps with Bloom's taxonomy which has been revised, HOTS include analyzing, evaluating, and creating (Najihah, et al., 2018). The ability to analyze is the basic ability of students to have HOTS and is one of the main abilities that need to be developed. Quoting Bloom's principle, the Directorate of Vocational High School Development 2017 states that the ability to analyze is to solve problems into greater specific parts and then

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organize those parts to discover the interrelationships (DitPSMK, 2017). One of the topics that require analytical skills is physics. In learning physics, students are not only able to count but are expected to be able to apply physics equations to solve problems in everyday life.

Based on the researchers' observations and interviews with the physics teacher at SMA Negeri 1 Petanahan Kebumen at the same time as wearing out internship 3, information became received that digital learning applied was still ineffective because students tended to be passive during learning activities, inflicting a lack of mastery of students' analytical abilities. On the other hand, students only receive material and assignments through learning media such as WhatsApp groups, google classroom, e-learning, and so on. Similarly, the teaching materials used still use student worksheets, e-modellus, and PowerPoint, so they have not yet led to practical learning to know the technique.

The use of learning media in the learning process can overcome, amongst others: (1) clarifying the presentation of messages so that they're not too verbalistic, (2) overcoming the restrictions of space, time, energy, and sensory power, (3) providing the equal stimulus, equating experience and creating the same perception, (4) Mastery of appropriate and varied media can overcome the passivity of students (Hartini et al., 2017; Wahyuni & Yokhebed, 2019). The form of developing information technology as a medium as well as supporting learning is the Learning Management System Modular Object-Oriented Dynamic Learning Environment (LMS Moodle). LMS Moodle is an application that facilitates the management of various teaching and learning activities (Cabero-Almenara et al., 2019; Hanafie Das et al., 2020; Nurdiyanti & Sukarmin, 2022). The accompanying teacher instructs students in describing the contents of the LMS Moodle. Each participant can become an instructor or student in a cooperative learning environment with LMS Moodle (Dhika et al., 2020; Kim, et al., 2019; Kurma & Sharma, 2016). LMS Moodle aims to inspire students to actively participate in learning through attractive designs with content associated with the phenomena of students' lives. Forms of learning materials can be included in the Moodle application, include as written scripts, Microsoft PowerPoint presentation materials, flash animations, and even audio and video format materials can be attached as learning materials to make it easier for students to carry out processes such as searching for information, collecting data, and practicing to solve questions in the Moodle application (Herayanti, et al., 2017).

In line with the objective of the LMS Moodle, an interactive simulation medium that can attract students' interest practically during digital learning is the use of Modellus. According to Neves and Teodoro, Modellus is software specifically designed to facilitate the teaching of physics; using Modellus allows users to create new applications without special programming skills. Modellus can be used to create interactive simulations, describe mathematical equations and display graphs simultaneously. Modellus is made in an interactive form that can describe scientific concepts in physics lessons (Maryam, 2021). The Modellus software presents physics material with graphs, data tables, animations, simulations, and mathematical equations. The advantage of this simulation media is that it is equipped with a student worksheets (Rezeki & Ishafit, 2017).

Taking gaps from the troubles and problem-solving executed by using preceding experts, it is necessary to research to examine the development of

Moodle-assisted LMS-based physics learning media so that it will be demonstrated in the form of learning video content material to improve students' analytical abilities.

METHOD

The research makes use of research and development techniques ADDIE (Pribadi, 2014) with the following steps: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. This development model is based on the reality that the ADDIE development design steps are simple, practical, easy to apprehend, and easier to practice in designing instructional media. The research was conducted at SMA Negeri 1 Petanahan with five students in class XI IPA 1 as subjects in a limited trial and eighteen students in class XI IPA 4 in a wide trial. The sample selection is made randomly. Data collection was done in this study using several methods, particularly: 1) observation technique, 2) validation sheet, 3) questionnaire method, and 4) test method. Data analysis achieved. Data analysis techniques for the feasibility of modellus-assisted Moodle LMS-based learning media validation sheets and learning achievement tests include collecting data from the validator; the scoring used is a scale of four. So that the data does not need to be changed, then converted into a qualitative criteria scale with reference as in Table 1.

Table 1 Reference for changing the scale value of four

Scoring Interval	Interpretation
0.00-1.69	Not good
1.70-2.59	Moderate
2.60-3.50	Good
3.51-4.00	Very good

With the purpose to make it easier to evaluate ratings, it needs to be transformed into percentages, Equation 1 is used (Purwanto, 2012), particularly:

$$NP = \frac{R}{SM} \times 100\,\% \quad (1)$$

Information:

NP = the percentage value sought/ expected
R = value obtained
SM = ideal value of the instrument
100 = fixed number.

To find out student responses, the steps for analyzing student response data include: 1) recapitulating student response questionnaire data, changing data expressed in percent form using equation (1), and changing it right into a qualitative standards scale with reference values as in Table 2.

Table 2 Assessment guideline criteria

Percentage Rate (%)	Category
86%-100%	Very good
76%-85%	Good
60%-75%	Enough
55%-59%	Reduce
≤ 54%	Very Less

The learning implementation is observers by two observers. The steps for analyzing the observation data of the implementation of learning are as follows: 1) recapitulating the response data from the observation sheet on the implementation of learning that the two observers have filled out, and 2) calculating the percentage agreement (PA). PA is used to calculate the reliability of the outcome of the evaluation of the implementation of studying that is carried out when implementing the learning process. In step with the Borich percentage agreement. The device is stated to be dependable if the percentage agreement (PA) value is more than one or equal to 75% (Trianto, 2013). To convert, use the PA criterion reference as in Table 3.

Table 3 PA criteria table

Value Range (%)	Information
76%–100%	Reliable
51%–75%	Reliable enough
26%–50%	Less reliable

The pretest and posttest data were used to determine the development of students' analytical abilities. Analysis of efficacy data was performed by recapitulating the rating fact obtained from the analytical skills pretest and posttest, then calculating his N-gain (Hake, 1999). The effects of the n-gain calculations are transformed to the n-gain category using the standards as proven in Table 4.

Table 4 N-gain criteria

Criteria	Category
g≥0.7	High
0.3≥g>0.7	Currently
g<0.3	Low

RESULT AND DISCUSSION

The researchers are developing a research purpose focusing on producing video media learning process based on LMS Moodle with Modellus to increase the student's ability in analysis and test eligibility. The development follows the procedure of developing media with the ADDIE model (Pribadi, 2014):

Analysis

In this stage, the researcher has analyzed the materials student needs and the material content useful to help the teachers teach progress in an online class at SMA Negeri 1 Petanahan Kebumen.

The use of media in SMA Negeri 1 Petanahan Kebumen in an online class in the form of a student working sheet, e-module, and PowerPoint. The student working sheet and e-module used were adapted from the current curriculum based on competency and the revised 2013 curriculum. On the other hand, there is no directed student to process the information and improve their analytical ability. In addition, the material teaching with no variation causes the student to have no interest in teaching physics.

Design

Based on the analysis, the first is to choose the media video learning physics based on LMS Moodle with Modellus to improve student ability in analysis skills. In this stage, begin with preparing and arranging the material. The second is to arrange the video learning physics process. The material development is not a printing media but learning video design, following the Canva and Filmora apps. In other hand, the video media learning physics process based on LMS Moodle with Modellus is arranged by schematic in Figure 1.

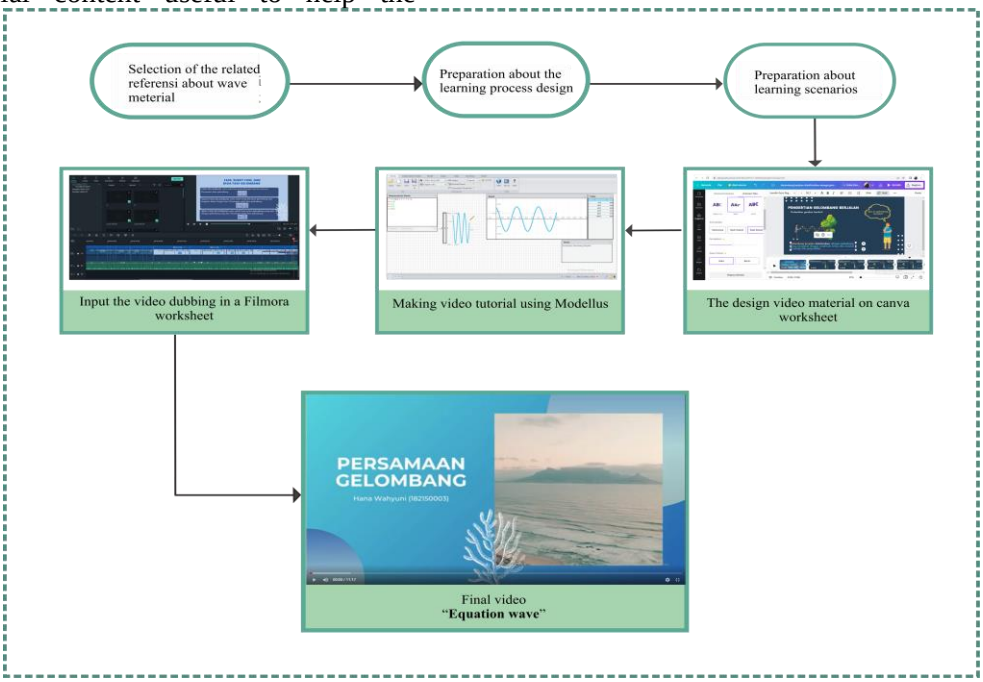

Figure 1 Design video learning physics process

Development

The development complies with validator experts, material experts, and product development testing. The draft has been validated and revised by trial inside the school. The limited trial has done by student grade XI IPA SMA Negeri 1 Petanahan Kebumen, the result will be considered in the final product. The result of the recapitulation is provided in Table 5, Table 6, and Table 7.

Table 5 Material expert validation results data

Aspect	Score		Average Score	Percentage
	Validator I	Validator II		
Contents	23	22	3.21	80.36%
Language	9	9	3.0	75.00%
Average Score			3.10	77.68%
Category				Good

Table 5 showed the result of the development of product video learning based on LMS Moodle with Modellus; finished the validation from two material experts, the rating may be converted to a scale of four. Based on the expert's validation data analysis, the scoring average is 3.10, with the Percentage of 77.68 % indicating a good category. In addition, it can conclude from the material that the media learning physics based on LMS Moodle with Modellus was developed to enhance student analysis skills.

An assessment of LMS Moodle assisted based on Modellus was finished by using two media experts. Assessment using a question scale of 1-4. In summary, the value recapitulation is provided in Table 6.

Table 6 Media expert validation result data

Aspect	Score		Average Score	Percentage
	Validator Expert 1	Validator Expert 2		
Design	16	17	3.3	82.5%
Cohesiveness	10	11	3.5	87.5%
Balance	9	9	3.0	75.00%
Average Score			3.27	81.67%
Category				Good

Based on the Table 6, the result of facts analysis using media experts confirmed the average rating from all aspects is 3.27 with a percentage of 81.67%, which means a good category. In addition, it can conclude from the material that the media learning physics based on LMS Moodle with Modellus was developed to interest the students in learning physics and to use as a media learning physics for wave equation material. This statement is supported by the researcher (Yuliana, 2019), stating the result of value by media experts using Moodle works with an average of close to 100%.

Based on the research, Moodle works to enhance student's understanding and the result of observation. The result of the (Susilawati & Ishafit, 2020) research stated that simulation media with Modellus is possible as a media learning process by the material and media expert and the questionnaire.

Two media experts assessed the test instrument. Assessment using a question scale of 1-4. In summary, the value recapitulation is presented in Table 7.

Table 7 Instrument test validation result data

Aspect	Score		Average Score	Percentage
	Validator Expert 1	Validator Expert 2		
Construction	16	14	3.75	93.75%
Contents	18	21	3.25	81.25%
Language	11	9	3.33	83.33%
Time	3	3	3.00	75.00%
Average Score			3.325	83.33%
Category				Good

Table 7, showed the result of the instrument test by two expert validators; the score after conversion is a scale of four. Based on the data analysis by the validator expert, the average score is 3.325, with a percentage of 83.33%, indicating a good category. In addition, it can conclude from the material that the media learning physics based on LMS Moodle with Modellus that the instrument test, the ability of analysis is in a good category indicating that it is possible to use in the learning process. The media product learning physics based on LMS Moodle-based Modellus has been done and gotten suggestions and critiques from the expert. The suggestion and critiques were used to referring any improvement and production of the media of learning physics that be ready to use for improving the ability of student analysis.

The media learning process has done development and testing for 5 students as a first subject, and the result of the testing using a questionnaire. The researcher used video learning physics by the subject development by limited testing.

The participant has done using video, the student should give some responses by the video learning physics. The result is proper to use.

Implementation

The data from implementation follow as student responsive, learning implementation, and the result of pretest and posttest students to video learning physics based on LMS Moodle with Modellus.

The questionnaire response from using learning with media development. Recapitulation of the questionnaire response student can be seen in Table 8.

Table 8 Students response results data

Aspect	Score	Percentage	Category
Use	123	85.42%	Good
Content Eligibility	243	84.38%	Good
Language	127	88.19%	Very good
Design	126	87.5%	Very good
Average	154.75	86.37%	Very good

Based on table 8, the result of data analysis by questionnaire response students showed a score of 154.75% for all factors with a percentage of 86.37% meaning “good” category. The response by students showed that the module works or is proper to use to examine, it has easy language to understand, it has an interesting design, and made the student easier in understanding physics material.

On the other hand, the student responses practically resulted from observing the implementation of learning. The result recapitulation data of implementation of learning in the trial has been achieved, provided by Table 9.

Table 9 Recapitulation data of implementation of learning

Aspect	Implementation			
	1		2	
	Observer 1	Observer 2	Observer 1	Observer 2
Preliminary	24	23	24	23
Core activities	18	19	18	19
Closing	12	11	12	11
Total	54	53	54	53
Percentage Agreement (*PA*)	99%		99%	
Criteria	Reliable		Reliable	

Table 9 shows that learning with the LMS Moodle assisted Physics learning using media assisted by Modellus obtained a PA of 99%; this value is included in the reliable criteria. This is because the learning that is carried out follows the syntax, starting from giving pretests to students, giving videos in Moodle LMS media, giving posttest analytical skills to students, and the evaluation process. Learning media may be stated to be effective if using those media can obtain the expected goals. The expected aim of this study is to increase students' analytical abilities. The effectiveness of Moodle-assisted LMS-based physics learning media on students' analytical abilities can be seen from the outcome of the pretest and posttest of analytical abilities. The outcomes of the pretest and posttest of students' analytical abilities can be seen in Table 10.

Table 10 Description of pretest and posttest results

Aspect	Indicator	Average		*gain*	Category
		pretest	*posttest*		
Differentiate	Focus	44.07	91.48	0.85	High
	Differentiate	20.28	84.44	0.80	High
Organize	Finding coherence	21.67	56.67	0.44	Currently
	Outlining	55.19	98.15	0.95	High
	Integrate	21.11	60.89	0.50	Currently
Attribute	Deconstruct	54.08	86.67	0.70	High
Average		36.07	79.72	0.70	High

Based on the results of the data analysis above, the n-gain is 0.7 with “high” criteria because the value of n-gain ≥ 0.7 are listed in Table 4. As a result, it is able to be concluded that all additives of students' analytical abilities have accelerated at posttest. Three additives get n-gain with “high” category indicators: focusing, differentiating, describing, and deconstructing. Even the indicators that get a medium N-gain are the indicators of integrating and finding coherence. The bar chart of the results of increasing students' analytical skills is provided in Figure 2.

Based on the effects of the data analysis, n-gain criteria of 0.7 is obtained with high criteria because the n-gain value is included in the n-gain criteria g ≥ 0.7 listed in Table 4. As a result, all components of students' analytical abilities experience an increase during the posttest. Three factors get n-gain with high category indicators: focusing,

differentiating, describing, and deconstructing. While the indicators that get n-gain are in the moderate category, namely finding coherence and integrating. The result why does it have the lowest value? This research is in line with research conducted by (Muhaimin, 2019) with the results showing a significant increase in students' analytical abilities with an n-gain value. The final results of the research are in step with research carried out by (Rofikoh, 2021), the results of the analytical ability test increased learning results with an n-gain of 0.71 consisting of the category high, so it's declared effective. So it could be concluded that Moodle-assisted LMS primarily based physics learning media with the help of Modellus can enhance students' analytical abilities.

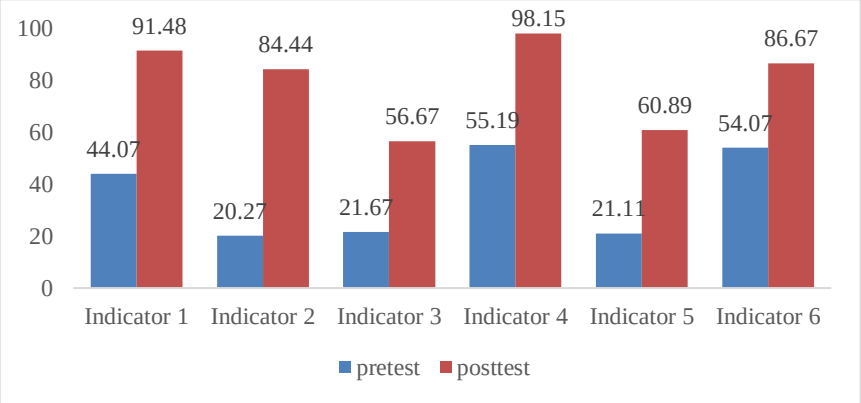

Figure 2 Analysis of ability test results

Evaluation

In this evaluation level, a value was given to the LMS Moodle-based physics learning video-assisted by Modellus. Material expert lecturers and media experts achieved the first evaluation. The evaluation was given to acquiring a validity value from the LMS Moodle-assisted physics learning video-assisted Modellus. In addition, experts also provide suggestions for product improvement. The outcomes of the validation of material experts acquired a mean rating of 3.10 which has the "good" criteria, and the validation from media experts acquired a mean rating of 3.27 which has "good" criteria. Furthermore, it changed into being tested extensively to measure students' analytical abilities. For analytical abilities, it experienced a high increase.

CONCLUSION

Based on the evaluation of research results and discussion, it may be concluded that the media learning physics based on LMS Moodle with Modellus was developed to enhance student analysis ability in phrases of the validity, practicality, and effectiveness of physics learning media. The realization is based mostly on the following: 1) physics learning media based on LMS Moodle with Modellus, which changed into advanced to get the outcomes of the validity of material experts and media experts inside the "good" category, as a consequence assembly of the valid criteria, 2) physics learning media based on LMS Moodle with Modellus which changed into advanced by testing the responses of students to using media developed inside the "very good" category. Whilst the data from the statement of the implementation of learning shows a reliable category, simply so it meets the practical criteria, and 3) physics learning media based on LMS Moodle with Modellus, which was changed into developed obtained pretest

and posttest ratings for analytical skills with n-gain which are protected inside the "high" category so that it meets the criteria for effectiveness.

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