PROBLEM-BASED LEARNING MODEL ASSISTED BY GOOGLE MEET FOR PARABOLIC MOTION TOPIC TO IMPROVE STUDENT LEARNING OUTCOMES

by Supartin Supartin

PROBLEM-BASED LEARNING MODEL ASSISTED BY GOOGLE MEET FOR PARABOLIC MOTION TOPIC TO IMPROVE STUDENT LEARNING OUTCOMES

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Abstract: This research aims to produce quality physics learning tools using the Problem Based Learning (PBL) learning model. The study was conducted at a public senior high school (SMA Negeri 1 Tapa), Gorontalo, Indonesia. The device was developed using the 4D development model developed by Thiagarajan and Semel. The research results on the device show that the developed device is of high quality. Learning tools are said to be valid for use with little revision. It can be seen based on the average validation results of 3.5 to 3.6. The effectiveness of learning devices is seen in the increase in student learning outcomes. It consists of the cognitive domain from the first meeting until the second meeting. It obtained N Gain 0.54 with N Gain criteria moderate, in the attitude domain with an average percentage of 81.77%. The results of observing student activities during two meetings: 71.80% with good criteria. psychomotor aspects with an average percentage of 80.36%, and the practicality of the developed devices seen from the observation sheet on the implementation of learning 84.78%, as well as teacher response questionnaires and student response questionnaires with an average the percentage of 79.88% and 84.80% got a positive response. There is an influence on student learning outcomes after the problem-based learning model is set with the help of the google meet application on parabolic motion material in the development of learning devices.

Keywords: Learning outcomes, 4D Development, Problem Based Learning.

INTRODUCTION

In early 2020, a new virus originating from Wuhan, China, shocked the world. This virus has attacked 215 countries around the world. This virus is called COVID-19 or Coronavirus-19, which attacks the respiratory system in humans with symptoms of acute respiratory distress, fever, cough, and shortness of breath. The World Health Organization declared a public health emergency caused by the virus on the 30th. The status of the Covid-19 pandemic has affected almost all aspects of human life. To break the chain of virus transmission, the Indonesian government, especially the Gorontalo government, has adopted many restrictive measures. Education is one of the sectors affected by this pandemic. The Ministry of Education and Culture has not allowed local governments to open schools outside the yellow and green areas. To fulfill the rights of students to obtain educational services and learning resources that are not limited by time and place. Therefore, it is hoped that this online learning activity can support the distance learning process and facilitate the distribution of material to students. Therefore, the learning process usually carried out face-to-face with teachers and friends at school is not carried out during this pandemic.

Online learning can be used as a solution for distance learning when a natural disaster occurs, as is happening now when the government establishes a social distancing policy. The government implements social distancing to limit human interaction and prevent people from crowding to avoid spreading the Covid-19 virus [1]. The development of learning tools is one way that can be used to optimize the learning process by selecting methods, models, and designs that can increase student interest and motivation so that it can have a major impact on student learning outcomes [2]. Learning tools needed to manage the learning process include the syllabus, Lesson plan, teaching materials, student activity sheets, evaluation instruments or learning outcomes tests, learning media, and student textbooks. Learning devices are several materials, tools, and media are instructions and guidelines used in the learning process [3]. The syllabus is a learning plan that includes competency standards, basic competencies, materials, learning activities, indicators, competency achievement for assessment, time allocation, and learning resources [4]. The lesson plan is a guide for teaching activities in learning activities and a description of student activities. The lesson plans were translated from the syllabus to direct student learning activities to achieve basic competence [5]. The National Education System stated in chapter 1, paragraph 1, article (20), "Learning is a process of interaction of students with educators and learning resources in a learning environment [6]. Teaching materials are materials that students must learn to achieve competency standards and basic competencies [7]. Student activity sheets are one of the learning resources that the teacher can develop as a facilitator in learning activities. Student activity sheets become learning and learning media

sources depending on the designed learning activities. Student activity sheets compiled must meet certain requirements to become a good quality Student activity sheet. Didactic, construction, and technical requirements that must be met. [8]

Learning outcomes are generally an evaluation of learning for some predetermined time so that teachers can see the abilities of their students—the provision of ways of working, solutions, methods, materials, and others [9]. Evaluating learning outcomes is a process to determine the value of student learning through assessment activity or measurement of learning outcomes" [10]—the components of the learning outcomes test, others, in the learning outcomes test. The component essay form can be; a set of questions, work instructions, and questions [11]. While the objective test has several components other than those in the essay test, namely choices, answer keys, and distractors. [12] said that a learning outcome test is a form of an evaluation tool to measure how far the learning objectives have been achieved. A good test must meet several requirements. It must be efficient, standard, have norms, be objective, valid (valid), and reliable (reliable) [8]

Problem Based Learning PBL is a set of learning models that use problems as the main topic to develop case-solving competencies, learning materials, and self-regulation [13]. The steps in implementing the PBL learning model there are five stages: 1) leading students to a problem; (2) organizing students to track; (3) assisting with individual and group investigations; (4) developing and presenting the work; (5) analyze and evaluate the problem-solving process [14]. The PBL learning model is carried out by exposing students to real problems in everyday life to develop their knowledge in solving problems and seeking various kinds of solutions that encourage students to think creatively. [15]. PBL is a model that emphasizes student-centered-based learning that can empower students to conduct investigations, integrate theory and practice, and apply their knowledge and skills to develop the discovery of solutions or solutions certain problems [16]. PBL characteristics are (1) learning begins with one problem; (2) ensuring that the problem is related to the real world of students; (3) organizing lessons around problems, not disciplines; (4) giving great responsibility to students in shaping and directly explaining the learning process; (5) using small groups; (6) requires students to demonstrate what they have learned in the form of products or performance [17].

The development model used in developing this learning device is the 4-D (Four D) development, model. The 4-D development model (Four D) is a learning device development model

developed [18]. The 4-D model consists of four stages, namely definition, design, development, and dissemination. Based on the background. The researcher intends to develop a learning device using a problem-based learning model that will be applied to online learning using development research methods. The research aims to develop a problem-based learning model device for online learning.

RESEARCH METHODS

This research is a research and development using a 4D development model. Developed by Thiagarajan, (1974), data collection techniques from this study were through constructed validation tests and practicality through observation of learning implementation, questionnaires for teacher and student responses to the learning process using Problem Based Learning learning tools. The data analysis technique used is a descriptive analysis of the validation results of learning devices, implementation observations are analyzed by calculating the percentage of implementation, and teacher response questionnaires and student responses are analyzed using a Likert Scale.

Define stage

At this stage, the development requirements are defined, and the learning tools used in SMA Negeri 1 TAPA are defined, namely:

a. Front end analysis

At this stage, the researcher detects the initial conditions of the learning tools made by the subject teacher and how the learning tools are expected.

b. Student analysis

At this stage, it examines the characteristics of students where students are the target of using learning tools which include the background of academic abilities (knowledge), the level of cognitive development of students, attitudes, individual and group work skills, and prior learning experience, economic and social background.

c. Concept analysis

At this stage, it is carried out to identify or systematically compile and detail the main concepts developed through learning tools. The concept chosen in this research is parabolic motion material. The material is presented using the 2013 curriculum by taking two basic competencies, namely:

1) Analyzing parabolic motion using vectors, along with their physical meanings in everyday life;

2) Presenting experimental data on parabolic motion and its physical meaning

d. Task analysis

At this stage, the researcher analyzes the main tasks that must be mastered by students so that students can master the material based on a problem-based learning model.

e. Analysis of the formulation of learning objectives

The learning objectives will appear in the lesson plans based on core competencies and basic competencies, namely indicators that will be achieved in the learning process. Based on basic competencies, learning indicators can be determined that provide an overview of what will be achieved.

Design Stage

a. Preparation of Learning Tools
In this selection, the researcher will arrange the learning tools developed. Learning tools follow the syllabus, Learning Implementation Plan, Student Worksheets, teaching materials, and Learning Outcomes Test. In developing learning tools, this stage is by making a syllabus, Learning Implementation Plan, Student Worksheets, teaching materials, and Learning Outcomes Tests by the provisions of the 2013 curriculum. learning.

b. Media Selection
In selecting the media, the researcher used the Student Worksheets and the teaching materials provided by the researcher by adjusting the material being taught. It aims to determine media according to the characteristics of students so that it will facilitate the delivery of learning material on the subject of parabolic motion.

c. Format Selection
The selection of the format aims to design and create the desired learning tools according to the objectives, learning models, methods, and learning resources.

Development Stage

The development stage aims to produce learning tools revised based on expert input and data obtained from trials. This stage includes product validation and revision of validation results.

RESULTS AND DISCUSSION

This research succeeded in producing quality learning tools, including valid, practical, and effective.

Learning Tool Validation

The learning tools developed were validated by expert validators, consisting of 2 lecturers in the Department of Physics at the State University of Gorontalo. Then will provide an assessment of the learning tools that have been developed, as for the aspects assessed, the feasibility of the content, legibility, and language.

Table 1 Average value of validation

No	Instrument	Validation average
1	Syllabus	3.6
2	Lesson Plan	3.5
3	Teaching materials	3.5
4	Pretest-postest	3.5
5	Questionnaire	3.5
6	Student Worksheets	3.5

Based on Table 1, it can be seen that the average validation results of the two validators are 3.5 and 3.6, so the learning tools developed are valid and feasible to be tested.

The practicality of Learning Devices

At this stage, the practicality of learning devices will be seen, which is based on several indicators: 1) The implementation of learning by teachers in managing Learning by the syntax of the Problem Based Learning learning model, 2) Teacher and student response questionnaires carried out at the end of learning activities.

Learning Implementation

The implementation of learning by teachers in managing learning by the syntax of the learning model Problem-based Learning at each meeting is in a good category. It means that the learning tools developed can be said to be good. The lesson plan developed is practical; it fulfills the second practical requirement, namely the implementation of learning by teachers in the good category. The implementation of learning by the teacher for two meetings based on observations is stated in the lesson plan.

Based on Table 2, the results of the learning implementation sheet above, the average score of learning implementation is 84.78 the good category. It shows that learning using the problem-based learning model can be carried out following the developed learning plan.

Table 2 Percentage of Learning Implementation

Meeting	Percentage of Learning Implementation %	Criteria
1	82.61	Good
2	86.91	Good
Average	84.78	Good

Teacher Response Questionnaire

In this study, the teacher's response to the learning tools that the researcher has developed consists of statements about the effectiveness of the syllabus, lesson plans, student worksheets, and pretest-postest. Implementation of Learning and the use of problem-based learning models.

Table 3 Teacher Response Questionnaire

Indicator	Category (%)			
	Less	Enough	Good	Very Good
Syllabus effectiveness	0	0	3.5	62.5
RPP effectiveness	0	0	41.7	58.3
Effectiveness of Teaching	0	0	37.5	62.5
LKPD effectiveness	0	0	44.4	55.6
THB effectiveness	0	0	33.3	66.7
Learning Model Effectiveness	0	0	40.0	60.0
Device quality	0	0	33.3	66.7

Table 3 shows the results of the teacher's response questionnaire are 84.804%. It is included in the very good category. It shows that according to the assessment of the subject teacher, the learning tools developed have met the practical requirements for use in learning.

Student response questionnaire

Student responses in this study were student responses to the use of problem-based learning models developed by researchers, which consisted of questions about the effectiveness of student worksheets, implementation of learning, and problem-based learning models. The scoring for each question uses a Likert scale, and the result data on student responses to learning tools can be seen in Table 4.

Table 4 shows that the student response questionnaire from indicators 1 to 6 can be said that the student's response to all the components stated is good. Students tend to respond positively to learning with a problem-based learning model. It is what makes students enthusiastic about participating in learning activities, and students more easily understand the parabolic motion material that has been taught.

Table 4 Student Response Questionnaire

Indicator	Category			
	Less	Enough	Good	Very Good
Syllabus effectiveness	0	24.8	49.6	25.6
RPP effectiveness	0	14.0	67.3	18.7
Effectiveness of Teaching	0	22.7	40.0	37.3
LKPD effectiveness	0	16.7	50.0	33.3
THB effectiveness	0	16.0	59.0	25.0
Learning Model Effectiveness	0	0.0	51.3	48.7
Device quality	0	0.0	57.6	42.4

Effectiveness of Learning Tools

a) Attitude learning outcomes

The attitude assessment measures the achievement of basic competencies in the spiritual attitudes of KI-1 and social attitudes of KI-2. The value of completeness of attitude competence is stated in the form of predicates, namely the predicates of Very Good (SB), Good (B), Enough (C), and Less (K). Data on the learning outcomes of the attitude aspect obtained through the assessment in the attitude observation sheet can be seen in Table 5.

Table 5 shows that the average value of attitude learning outcomes is 81,777. It shows that learning with a problem-based learning model can be effective because it includes Good criteria by getting a B predicate.

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Table 5 Attitudes of Students

Meeting	Percentage of Attitude Learning Results %	Criteria	Predicate
1	81,319%	Good	B
2	82,234%	Good	B
Average %	81,777%	Good	B

b) Skills Learning Outcomes

The results of learning aspects of student skills are obtained through observations during learning activities in 2 meetings when students write reports on the investigation results. Aspects assessed include: (1) writing the title of the report and the names of group members; (2) writing down the purpose of the investigation; (3) writing down the tools and materials that have been used; (4) writing down the investigation procedure; (5) write down the data of the results of the investigation; (6) analyze the data obtained; (7) conclude the results of the investigation. The analysis results show that all students are declared complete with a score between 3.67 - 4.00 with predicates A- and A. Students are said to be complete for the skill aspect with an optimum achievement of 2.67. The skill of writing research reports for students is something new. After guidance and improvement were made at the next meeting, the results obtained were better.

Table 6 Skills Learning Outcomes

Meeting	Percentage of Skill Learning Results %	Criteria	Predicate
1	75,13%	Good	B
2	85,60%	Good	B
Average %	80,36%	Good	B

Table 6 depicts the learning outcomes of students' skills are said to be effective, with an average value of 80.36%. It shows that learning using a problem-based learning model includes the Good criteria by getting the predicate B.

c) Knowledge learning outcomes

The Concept Mastery Test was given two tests, namely before learning (pretest) and after learning (posttest), with a problem-based learning model. The student's concept mastery test results are used to determine the completeness of the learning outcomes of students' knowledge aspects.

Table 7 N-Gain Learning Outcomes

Pretest	Posttest	N-Gain	Criteria
43,377	73,714	0,54	Currently

Based on Table 7, the average value of the pretest and post-test for two meetings has increased by obtaining an N-gain score in the moderate criteria for 2 meetings. By looking at the improvement in the learning outcomes tests obtained by students, it can be said that the learning tools developed are effective.

Device development process

The method used in this research is development research. The development model used to develop learning tools is a modified Four-D model: the definition stage, the design stage, and the developing stage.

Learning tools on parabolic motion material (syllabus, lesson plans, teaching materials, student worksheet, pretest-postest, and assessment instruments), designed and validated by expert validators, obtained valid and appropriate learning tools for use. Based on the validation results of learning tools developed and revised based on suggestions and corrections from the validator. The essence of developing learning tools is based on the four D model, which is in the third stage, called the development stage. The researcher has designed the device and is validated by an expert validator at this stage. This validation can be in the form of suggestions and input from experts that will be used to revise learning tools.

The development stage is the stage in producing a product that has been developed. Several steps are carried out at the development stage, starting with validation or assessment by experts and practitioners. Regarding the tools developed, it was followed by a limited trial of learning tools. Finally, several observers carried out an assessment related to the implementation of the lesson plans made. The device development trial in this study was conducted at SMA Negeri 1 IPA by involving 25 students in class X Science. Based on the trial results, the final product of the learning device developed was obtained.

The study results show that the learning device with parabolic motion is a valid learning device

with feasible conclusions. The descriptive analysis of the development of learning devices on parabolic motion material with a problem-based learning model using the four D development model can be based on several points: 1). The results of the expert validation of the parabolic motion device; 2). The results of observing the implementation of learning devices in the classroom; 3) Teacher response questionnaires and student response questionnaires; 4). The results of observing student activities; 5). The ability of students' learning outcomes on parabolic motion material in terms of knowledge, attitudes, and skills after implementing the problem-based learning model

The learning tools developed aim to produce quality learning tools regarding three indicators: valid/feasible, effective, and practical. The ability to plan lessons from a teacher can be reflected in how he prepares valid learning tools to be suitable for use in learning. Planning is the initial activity that everyone must do if they want to carry out activities. That is why the preparation of learning tools is important for teachers to do before they carry out learning.

Quality of learning tools
a) Validation of learning tools

The preparation of learning devices is done by preparing appropriate learning to be used in the learning process. Expert validators validate to determine whether or not the device made is feasible to prepare appropriate learning tools. The experts' validation results can be used to determine whether the learning device is made to meet the expected feasibility standards. Experts' suggestions and input are needed to determine whether or not the learning device is made. The improvement of the learning device that has been designed greatly determines the quality of the device itself. The validation of learning tools is the stage of determining the results of this study. The results of the validation of the experts can be used as the basis for determining whether the learning tools made meet the expected feasibility standards. Suggestions and input from experts for the improvement of learning tools that have been designed greatly determine the quality of the device itself.

The validation of learning devices by expert validators indicates that the learning devices made are suitable for learning the parabolic motion material. The validation carried out by the expert validator refers to the four areas of study as stated in the validation, namely the construction field, the content field, the legibility field, and the language field. The learning tools developed are valid and can be used [19].
b) Practicality

c) The practicality of learning tools is seen from the observation of the implementation of learning and questionnaires for teacher and student responses to learning using problem-based learning models. The analysis results showed that the percentage of learning implementation at the first meeting was 82.261%. At the second meeting, it was 86.96%, so based on this percentage, the average percentage was 84.78%. With the "good" category as is in line with what was stated by [20]. Based on the results of the percentage analysis, it can be said that the learning tools developed are practically used in terms of the implementation of the learning carried out.
d) Effectiveness

The effectiveness of the learning tools developed can be seen from the activities of students during the learning process and learning outcomes tests. The percentage of student activity obtained at the first meeting of 71.500%. In the second meeting, the results of 72.115% were obtained, so an average percentage of 71.808% was obtained in the "good" category. The percentage gain from 60-80% of student activity is categorized as "good". Each meeting, there has been an increase in student activity.

The criteria for the effectiveness of learning devices are also seen in students' learning outcomes from the cognitive, affective, and psychomotor domains that students carry out during the learning process.

Based on the analysis results, the average learning outcomes of the individual pretest and posttest were 43.377% and 73.714%, with an N Gain score of 0.54%. In the pretest, one student scored 49.35%, four students scored 48.05%, three students scored 46.75%, three students scored 45.45, four students scored 44.15%, three students got a score of 42.85%, one student got a score of 41.44%, two students got a score of 40.25%, two students got a score of 36.36%, one student got a score of 35.05%, and one student got a score of 31.16%. Based on the values obtained by students in the pretest, it is categorized as "less". Then in the posttest 18 students scored 71.42% - 84.41% with "good" criteria and 7 students scored 66.23% - 70.42% with "enough" criteria. It can be seen that there has been an increase in learning outcomes from pretest to posttest. From the results of the analysis that has been described, the learning device is said to be effective.

Learning outcomes in the affective domain through the analysis of attitude assessment sheets. The percentage obtained is 81,319% at the first meeting, while at the second meeting, the results are 82,234%, so the average percentage is 81,777% in the "good" category. It can be said that the

learning tools developed are effective based on the assessment results.

Analysis of skills assessment at the first meeting obtained 75.128% results, and the second meeting obtained 85.600% results, so the average percentage obtained from the first meeting to the third meeting was 80.364% in the good category. It can be said that the tools developed are effective in terms of skills assessment.

CONCLUSION

The development of problem-based learning tools on the parabolic motion material that has been developed is of quality based on the level of feasibility. The validation results with an average score of 3.4-3.6 are included in the good category deserve to be tested. The level of practicality of the learning tools that have been developed. The results of the average percentage of learning implementation with two meeting namely 84.78%. And the level of effectiveness can be seen from the average percentage of individual knowledge learning outcomes assessment of 0.54, the average attitude learning outcome is 81.777%, and 80.364% of skills learning outcomes are in a good category.

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