



## Development of Project Based Learning Model Assisted by Geogebra Software to Improve Student's Creative Thinking Ability at SMKN 1 Penanggalan

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**Abstract.** Mathematics is one of the supporters of the development of science and technology. The low creative thinking of students is one of the causes of students' lack of interest in learning mathematics. The assumption for most students that mathematics is a very heavy and difficult subject, especially in solving Geometry Transformation problems. The purpose of this research is to improve students' creative thinking skills through the development of project-based learning models assisted by geogebra software and the effectiveness of these learning models. This development uses the ADDIE (Analysis, Design, Development, implementation and Evaluation) model. The trial was conducted in class XI TKJ SMK N 1 Penanggalan, Penanggalan District, Subulussalam City, Aceh Province. The results showed that in the first trial there were 12 students who completed with 60% and 8 students did not complete with 40% so that they could not meet the effective criteria. In the second trial there was an increase in creative thinking skills for students who completed as many as 18 students, 85.7% and students who did not complete as many as 3 students, 14.3%. So that the development carried out in the second trial showed an increase in students' creative thinking by 25.7%.

**Keyword:** Mathematics Learning, Project Based Learning, Geogebra Software, Creative Thinking Ability.

**Abstrak.** Matematika merupakan salah satu pendukung perkembangan ilmu pengetahuan dan teknologi. Rendahnya berpikir kreatif siswa salah satu penyebab daya tarik siswa terhadap pembelajaran matematika kurang. Anggapan bagi sebagian besar siswa matematika merupakan mata pelajaran yang amat berat dan sulit, terutama dalam menyelesaikan soal-soal Transformasi Geometri. Tujuan dari penelitian ini adalah untuk meningkatkan kemampuan berpikir kreatif siswa melalui pengembangan model pembelajaran project-based learning berbantuan software geogebra dan efektifitas model pembelajaran tersebut. Pengembangan ini menggunakan model ADDIE (Analysis, Design, Development, implementation dan Evaluasian), Uji coba dilakukan di kelas XI TKJ SMK N 1 Penanggalan, Kecamatan Penanggalan, Kota Subulussalam, Provinsi Aceh. Hasil penelitian menunjukkan bahwa pada uji coba I terdapat 12 siswa yang tuntas dengan 60% dan tidak tuntas 8 siswa dengan 40% sehingga belum dapat memenuhi kriteria efektif. Pada uji coba II terdapat peningkatan kemampuan berpikir kreatif terhadap siswa yang tuntas sebanyak 18 siswa 85,7% dan siswa yang tidak tuntas sebanyak 3 siswa 14,3%. Sehingga

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*pengembangan yang dilakukan pada uji coba II menunjukkan peningkatan berpikir kreatif siswa sebesar 25,7%.*

**Kata Kunci:** *Pembelajaran Matematika, Project Based Learning, Software Geogebra, Kemampuan Berpikir Kreatif.*

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## 1 Introduction

Education is a conscious effort made by teachers to students in order to reach maturity. This is in line with [1] stating that education is a process of changing human attitudes to develop one's own abilities for the better. The process is passed by each individual through education as outlined in the learning process.

Learning is a system, which consists of various components that are interconnected with one another [2]. These components include: objectives, lesson materials, teaching activities, methods, tools and evaluations. These learning components must be considered by the teacher in selecting and determining what learning models will be used in learning activities. The word learning is a process, method or act of making people or living things learn.

The picture that appears in current learning is the emphasis on learning is more on rote memorization and looking for the correct answer to the questions given. Higher order thinking processes including creative thinking are rarely trained. In learning, students are less encouraged to improve their creative thinking skills. The learning process in the classroom is still teacher-centered which is directed at the ability of students to think convergently by memorizing information, remembering and hoarding various information without being required to understand the information that is remembered to connect it with everyday life.

One of the innovative learning that is relevant to the involvement and active role of students in developing creative thinking skills is a student-centered learning approach, namely project based learning. Stated that, "Project-based learning or Project Based Learning is one of the efforts to change learning that has been teacher-centered to become student-centered learning [3]. Project-based learning is designed for students to investigate as well as understand when dealing with complex problems.

The Project Based Learning model (project-based learning) is seen as a learning model that can be used by teachers and students in implementing the learning process as an effort to develop mathematical problem-solving abilities and Self-Regulated Learning. The need for a technological innovation that supports learning and provides benefits, one of which is using software/applications that can be used by everyone.

Innovation in computer-assisted learning has a very good impact if it is mixed with learning mathematical concepts, especially in the fields of geometric transformation, calculus, statistics,

and graphs of functions [4]. One of the computer programs that can be used is GeoGebra Software. The assistance that can be obtained from the GeoGebra Software is the initial sketch of making graphics for SMK students. The assistance is expected to make it easier for students to carry out learning using the Project-Based Learning model which provides more opportunities for students to manage their projects independently.

The explanation above can be concluded that in carrying out Project Based Learning assisted by GeoGebra Software, it is indicated that it can develop students' creative thinking skills in solving problems or in completing a task given to students. In addition, students will become more independent and provide students to become more mature and can implement the knowledge or experience they have to solve problems and can interact well with the surrounding environment [5].

Based on the description above, the researcher wants and is interested in conducting research with the title "Development of Project Based Learning Models assisted by GeoGebra Software to Improve Students' Creative Thinking Skills at SMK N 1 Penanggalan".

## 2 Literature review

This study uses the Research and Development (R&D) method with the ADDIE model. Development research is research oriented to developing and validating products used in education. The conditions for producing certain products are needs analysis research and to test the effectiveness of development research is needed [6]. The development that will be carried out is a model Project Based Learning learning assisted by Geogebra software to improve students' creative thinking skills. The ADDIE development concept used is analysis, design, development, implementation, evaluation.

### a. analysis

In the analysis phase, an analysis of student needs, material analysis and analysis of student characteristics was carried out, namely interviews with the mathematics teacher of class XI SMK N 1 Penanggalan. The results of the analysis are [7]:

1. There are still many students who are less responsive in remembering and understanding the lessons delivered by the teacher.
2. There is still a lack of teachers using media in the learning process
3. Students need a student-centered learning model, namely the Project Based Learning model that can improve students' creative thinking skills.

#### b. Planning (Design)

The activity at this stage is to design a learning implementation plan (RPP) with a project-based learning model assisted by geogebra software. as follows [7]:

1. Schedule: includes the RPP design schedule, RPP analysis, and product manufacture. In making the RPP, it is scheduled to be completed before carrying out the research.
2. Team: making lesson plans with the Project Based Learning model requires a work team with their respective duties and roles consisting of: writers as learning model developers, expert teams consisting of a mathematics lecturer and a vocational mathematics teacher to assess lesson plans products The results obtained consist of aspects of competency achievement indicators (GPA), learning objectives, learning main materials, learning models, learning resources, languages and tools, learning steps/syntax of project based learning models, time allocation, language use.

#### c. Development

[8] The development stage is the process of realizing a learning implementation plan using a project-based learning model with the help of geogebra software into a reality. the development stage of developing a project-based learning model with the help of geogebra software includes several stages, namely: RPP products that are validated by lecturers and expert mathematicians, RPP developed is tested for feasibility. Suggestions, inputs and improvements from the validation results are then used to improve the RPP so that a revised RPP is obtained before being tested.

#### d. Implementation

This implementation stage is the stage where the product is tested to find out and collect data on the effectiveness of the Project Based Learning model with the help of Geogebra Software to achieve valid and effective mathematics learning goals. The data is used to improve the learning implementation plan along with the learning steps carried out on the students. The trial in this study was in a small group trial. The trial was conducted to see the creative thinking ability of students towards the products resulting from the development of a project-based learning model with the help of geogebra software.

#### e. Evaluation

At this evaluation stage, several stages were carried out, namely evaluation through the RPP product validation process by a team of experts, namely mathematics education lecturers and mathematics teachers, after the product was compiled and developed then the product was evaluated by a team of experts to get suggestions and input on the RPP product. Evaluation is a process to see whether the learning system that is being built is successful in accordance with

initial expectations or not. Evaluation aims to see the feasibility of a product (fit or not to be used in the learning process). The instruments that will be used in this research are the learning device assessment sheets are as follows:

### 1. Learning Device Research Sheet

The learning device assessment sheet is used to measure the validity of the developed learning device [8]. The assessment sheet is filled out by expert lecturers and mathematics teachers. The learning device assessment sheet is divided into four, namely:

#### a. RPP Assessment Sheet by Expert Lecturers

This RPP assessment sheet is given to an expert lecturer. The results of the assessment by expert lecturers are used to determine the validity of the lesson plans developed based on aspects of Competency Achievement Indicators (GPA), learning objectives, learning main materials, learning models, learning resources, languages and tools, learning steps/syntax Project Based models.

### 2. Data analysis techniques for RPP learning devices

#### a. Validity

The validity of the lesson plan learning tools was obtained based on the results of data analysis on the assessment sheet for learning tools for expert lecturers and mathematics teachers. Validity analysis was carried out in the following steps:

[9] Tabulate the score data on the results of the learning device assessment by grouping the statement items according to the observed aspects. Table 3.4 below is a scoring guideline for the results of the assessment with a Likert scale of 1-5

**Table 1:** Scoring Guidelines for Assessment Results Using a Likert Scale

Criteria	Score
Very Good	5
Good	4
Enough	3
Bad	2
Very Bad	1

In general, the aspects assessed are Competency Achievement Indicators (GPA), learning objectives, learning subject matter, learning models, learning resources, language and tools, learning steps/syntax of Project Based Learning model, time allocation, language use.

- b. Determining the category of validity by matching the total average with the criteria for the validity of the lesson plans, namely:

**Table 2:** RPP Validity Categories

Score Interval	Criteria
$4 \leq RTV_{RPP} \leq 5$	Very valid
$3 \leq RTV_{RPP} < 4$	Valid
$2 \leq RTV_{RPP} < 3$	Not valid
$1 \leq RTV_{RPP} < 2$	Invalid

- c. Analysis of Improving Creative Thinking Ability

The analysis of students' creative thinking abilities consists of analyzing the value of students' creative thinking abilities and the criteria for the level of creative thinking abilities. To get the value of students' creative thinking skills, the following calculations are carried out:

1. Calculating student scores determines the completeness of each student based on the KKM that has been set by the school, which is 70.
2. Calculating the average results of students' creative thinking with the formula

$$x = \frac{(\text{total number of student learning outcomes})}{(\text{number of students})}$$

3. Calculating the average percentage of students' overall creative thinking results with the formula:

$$x = \frac{(\text{number of students who completed})}{(\text{number of students})} \times 100\%$$

Meanwhile, the criteria for the level of creative thinking ability based on those used are shown in table 3 [10].

**Table 3:** Thinking Ability Criteria

Score	Weight	Category
86-100	4	Very Good
76-85	3	Good
66-75	2	Enough
56-65	1	Bad
$\geq 55$	0	Very Bad

### 3 Result and Discussion

Expert validation is a lesson plan validation activity and creative thinking ability test questions that are carried out before the results are tested. Validation is done by assessing the lesson plans and students' creative thinking test questions given to experts, namely mathematics education lecturers at UISU and mathematics school teachers at SMK N 1 Penanggalan. The results of the assessment can be seen in table 4.

**Table 4:** Expert Validation Results on RPP and Students' Creative Thinking Ability Test Questions

No	Validation Number	Average Validation Result	Description
1	RPP	3,6	Good
2	Test of Creative Thinking	3,8	Good

From the validation results above, it shows good and valid results, and can be used to be tested on students. One of the activities designed in this lesson plan is to complete and discover the concepts of Translation, Reflection, Rotation, and Dilation. And students are able to apply it to the geogebra software. In this activity, the researcher wanted to see student responses through questionnaires and students' creative thinking skills in problems given to students towards project-based learning assisted by geogebra software. the following are the results of the student response questionnaire and the results of students' creative thinking abilities can be seen in table 5.

**Table 5:** The results of student questionnaires and tests of students' creative thinking skills

No	Validation Material	Average	Description
1	Student Response Questionnaire	3,49	Very Good
2	Creative Thinking Ability Test Results	81,4	Finished

From the results of student responses showed very good results through the questionnaire that the researchers gave to each student. And the results of the student's creative thinking ability test were obtained with an average of 81.4 out of 21 students in class XI TKJ 2 with a complete category.

From the classical results also show that there are 18 students who have completed and 3 students who have not completed with the percentage who complete is 85.7% who are complete.

This study aims to determine the improvement of students' creative thinking skills and the effectiveness of the Project Based Learning model with the help of geogebra software developed in improving students' creative thinking skills.

#### 1. Description of Increasing Students' Creative Thinking Ability Using Project Based Learning Models with the Help of Geogebra Software

The increase in students' creative thinking skills can be seen from the results of the analysis of trial 1 and trial 2 and the overall average value and can be seen to increase the ability to think classically. The results of increasing creative thinking skills from trial I to trial II show creative thinking in the results of trial I with an overall average of 62.7 increasing to 81.4 in trial II. From the classical learning mastery, it was obtained that 12 students who completed the first trial with a percentage of 60% and students who did not complete it were as many as 8 40% while in the second trial there were 18 students with a percentage of 85.7% of students who completed and 3 students with a percentage of 14.3% who did not complete.

#### 2. Description of the Effectiveness of the Geogebra Software Assisted Project Based Learning Model

In this study, the effectiveness of the development of Project Based Learning model assisted by Geogebra software is viewed from the student response questionnaire. The learning model is said to be effective if students give a positive response. Positive responses, namely at least 80% of students who take part in the learning respond in the minimally good (positive) category. Based on the results of the study, it was found that the overall average was 3.49 in the very good category.

In addition, it was also found that as many as 17 students (80.9%) responded to the learning in a very good category and as many as 4 students (19.1%) responded in a good category. In accordance with the indicators of effectiveness on student responses, namely positive if there is at least 80% of students who take part in the learning respond in the minimally good category. Therefore, the student's response to learning is positive.

## 4 Conclusion

Based on the results of the analysis and discussion in this study, several conclusions are put forward as follows.

The results of the assessment of students' creative thinking abilities, respectively, in the first trial results were 62.7 after developing a Project Based learning model from the aspect of essential



questions and the steps for using geogebra software in video form, it increased to 81.4 in trial II. And the percentage of students' creative thinking ability classically shows that in the first trial there were 12 students who completed with a percentage of 60% and 8 students did not complete with a percentage of 40% so that they could not meet the effective criteria. In the second trial there was an increase in creative thinking skills for 18 students (85.7%) who completed and 3 (14.3%) incomplete students. So that the development carried out in the second trial showed an increase in students' creative thinking by 25.7%.

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