# THE EFFECT OF LEARNING MODELS ON MATHEMATICS LEARNING OUTCOMES IN TERMS OF LEARNING INDEPENDENCE  IN GRADE VIII

**Poni Lestari[a], Uswatun Khasanah[b]**
Program Studi Pendidikan Matematika Universitas Ahmad Dahlan
Jalan Ring Road Selatan, Tamanan, Banguntapan, Bantul Yogyakarta
[a]poni1600006168@webmail.uad.ac.id, [b]uswatun.khasanah@pmat.uad.ac.id

## ABSTRACT

The purpose of this research to whether or not there is a significant effect (1) the Problem Based Learning (PBL) model on the mathematics learning outcomes of VIII grade students of Junior Hih School (SMP) Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 Academic Year (2) the level of learning independence on the learning outcomes of VIII grade students of SMP Muhammadiyah 3 Yogyakarta Even Semester of the 2019/2020 Academic Year, (3) the interaction between the Problem Based Learning model with learning independence on the mathematics learning outcomes of VIII grade students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 Academic Year. The population in this research was all VIII grade students of SMP Muhammadiyah 3 Yogyakarta. The random sampling technique took class samples. Data collection techniques used observation and tests. The research instrument was a test of learning outcomes and observation of student independence. The data analysis technique used includes the prerequisite test and hypothesis test. The results of the research at a significant level of 5% with DF= 1 indicate, (1) there is an effect of the Problem Based Learning model in mathematics learning outcomes, obtained $F_{obs}$ (A) > $F_{0,05; 1; 47}$, (2) there is an effect of the level of learning independence on mathematics learning outcomes, obtained $F_{obs}$ (B) > $F_{0,05; 1; 47}$, (3) there is no significant effect of the interaction between the learning models and learning independence on mathematics learning outcomes, obtained $F_{obs}$ (AB) < $F_{0,05; 1; 47}$.
**Keywords:** Problem Based Learning (PBL), independence of students, Learning outcomes

## INTRODUCTION

Education is an essential element in supporting and advancing the quality of a nation. The quality of human resources determines the success of a country. Therefore education needs to be carried out in an integrated, harmonious, and orderly manner. The government's active participation, various community groups, parents, and the education council supports education implementation. A quality learning process can be achieved with effective and efficient learning where teachers and students play an active role during the learning process. There are several ways that teachers can improve the quality of the learning process, including choosing a learning model, providing motivation, and embedding concepts appropriately in every subject matter. Therefore, teachers can plan and select the right learning model to create a quality learning process.

Mathematics is a source of other sciences. Mathematics is one lesson that can train some of its abilities, namely critical, logical, thorough, creative thinking, reasoning, problem-solving, and understanding a concept (Erman Suherman et al., 2003). Students need to understand mathematical concepts to be used to develop knowledge and apply them in everyday life. Student learning outcomes are one of the benchmarks in seeing students' understanding of mathematical concepts during learning.

Based on the observations made at SMP Muhammadiyah 3 Yogyakarta, student learning outcomes are still low. In addition to student learning outcomes, which were still soft when the mathematics learning took place, students tended to be passive and paid less attention to the teacher. Most of the independent learning has not appeared in some students. It can be seen from the attitude of taking the initiative to act, appreciating their work, empowering their abilities, and having confidence in learning for some students. The learning model applied in the classroom is less varied. Teachers still dominate learning, and it does not attract students to be active.

Poor learning outcomes mean that the level of student learning success is still low. One of the factors that influence the low level of learning success is determining the learning model that is not suitable for student characteristics. There are various student characteristics, including motivation, interest, learning style, intellectual intelligence, creativity, independence. According to Tirtarahardja and La Sulo (2015:50), independence in learning is a learning activity that takes place more driven by their own will, their own choice, and their responsibility. The concept of independence in learning will only reach learning outcomes from skills, development of reasoning, and attitude formation to self-discovery if students experience learning outcomes. Sigit Sujatmika (2016:117) revealed that the Problem Based Learning learning model is a learning model that can activate students during the learning process. Also, Problem Based Learning designs a learning atmosphere to solve problems both individually and in groups. By involving students in solving problems that have been conditioned in such a way, students will think optimally and activate their potential so that the learning process is more lively. Educators, both teachers, and lecturers act as guides and facilitators during learning activities. Elea Tinggih, in Suherman et al. (2003), states that Mathematics means knowledge obtained by reasoning. This means that mathematics emphasizes activities in the world of ratio (reason). Simultaneously, in other sciences, it highlights the results of observations or experiments and reasoning.

According to Arends in Karunia et al. (2015:43), PBL is a learning model where students are faced with authentic (real) problems so that they are expected to be able or able to compile their knowledge, develop high-level inquiry and skills, independent students and increase their self-confidence. According to Sani (2016:139-140), the steps for the problem-based learning model are as follows: 1) Provide problem orientation to students, 2) Organizing students for investigations, 3) Carry out studies, 4) Develop and present the results, 5) Analyze and evaluate the investigation process.

According to Tahar & Eceng (2006: 93) that learning independence is a learning activity carried out by individuals with their freedom to determine and manage their teaching materials, time, place, and utilize various learning resources needed. According to Suharnan (2012), the indicators of learning independence are as follows: 1) Taking initial action. 2) Appreciate your results. 3) Empowering the capabilities they have. 4) Have self-confidence. In this study, the independence indicator used is the independence indicator, according to Suharnan.

According to Huri Suhendri (2011:32), mathematics learning outcomes are the culmination of learning activities in the form of changes in cognitive, affective, and psychomotor forms in terms of abilities about numbers, shapes, concepts, and logical relationships that are continuous and can be measured or observed.

Based on the description above, the objectives of this study are as follows: 1) Knowing whether or not there is an effect of the Problem Based Learning learning model on the mathematics learning outcomes of class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year on the subject of Circles. 2) Knowing whether or not there is an effect of the level of independent learning on the learning outcomes of class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year on the subject of Circles. 3) Knowing whether or not there is an effect of the interaction between the Problem Based Learning learning model and independent learning on the mathematics learning outcomes of class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year on the subject of Circles.

## METHODS

This type of research is experimental research using factorial design.

**Table 1.** Research Design

| Learning model | | Independence | |
| | | B | |
| | | Low | High |
| A | PBL | Learning outcomes | Learning outcomes |
| | Conventional | Learning outcomes | Learning outcomes |

(Sudjana,2002:112)

This study's population was all grade VIII students of SMP Muhammadiyah 3 Yogyakarta in the 2019/2020 school year. In this study, the sampling was done by using a random sampling technique to the class. The sample class was taken by lottery to determine the experimental class and the control class. After the drawing was carried out from a population consisting of eight categories, it was found that class VIII C is an experimental class composed of 25 students and class VIII B is a control class consisting of 26 students.

      The data collection techniques used in this study were observation and tests. The research instrument was a test of learning outcomes and statements of student independence. Observation data were obtained using observation sheets on student learning independence, carried out directly on students during learning activities. The observation data obtained were in the form of a scored assessment, "Yes" was given a score of 1, and "No" was given 0. Suppose the student does what is written on the observation sheet. In that case, it is marked with the word "Yes," on the other hand, if the student does not take action as noted on the observation sheet, the term "No" is marked.

      The observation sheet to determine the students' learning independence scores uses the Guttman scale as follows:

**Table 2.** Guttman Scale Categories

| Assessment | Score |
|------------|-------|
| Yes | 1 |
| No | 0 |

(Sugiyono, 2015: 139)

The test technique used in this research is a test method in the form of an objective test in multiple choices with one correct answer from the four answer choices. The assessment in this test is that if the student answers correctly, then they are given a score of 1 (one) and if one is given a score of 0 (zero). The data analysis technique used in this study includes prerequisite tests and hypothesis testing.

**RESULTS AND DISCUSSION**

      From the normality test that has been carried out in the experimental class and control class with a significant level of 5% ($\alpha = 0{,}05$) and the decision criteria used are $\chi^2_{count} < \chi^2_{table}$, then $H_0$ is accepted, which means that the experimental class and control class are normally distributed.

      The homogeneity test was carried out in the experimental class. The control class with a significant level of 5% ($\alpha = 0{,}05$). The decision criteria used are $\chi^2_{count} < \chi^2_{table}$ than $H_0$ accepted, which means that the experimental and control classes are homogeneous.

      In this study, hypothesis testing was carried out through statistical methods using two-way ANAVA with two-way variance with no cells. In contrast, the summary of the two-way ANAVA analysis results can be presented in the following table.

**Table 3.** List of ANAVA Mathematics Learning Outcomes Test

| Source | JK | DF | RK | $F_{obs}$ | $F_\alpha$ | P |
|--------|-----|-----|-----|-----|-----|-----|
| Learning Model (A) | 1705,849 | 1 | 1705,84855 | 8,601275 | 4,03 | < 0,05 |
| Independence (B) | 4690,073 | 1 | 4690,07336 | 23,64841 | 4,03 | < 0,05 |
| Interaction (AB) | 606,1741 | 1 | 606,174131 | 3,056467 | 4,03 | > 0,05 |
| Error | 9321,278 | 47 | 198,325072 | - | - | - |
| Total | 16323 | 50 | - | - | - | - |

      Because $F_{obs}$ (A) = 8.601275 and $F_{0.05; 1; 47} = 4.03$ then $F_{obs}$ (A)> $F_{0.05; 1; 47}$ so that $H_{0.1}$ is rejected, which means that there is an effect of the learning model on mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta Even Semester for the 2019/2020 Academic Year.

Because $F_{obs}$ (B) = 23.64841 and $F_{0.05; 1; 47}$ = 4.03 then $F_{obs}$ (B) > $F_{0.05; 1; 47}$ so that $H_{0.2}$ is rejected, which means that there is an effect of independent learning on mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta Even Semester for the 2019/2020 Academic Year.

Because $F_{obs}$ (AB) = 3.056467 and $F_{0.05; 1; 47}$ = 4.03, then $F_{obs}$ (AB) < $F_{0.05; 1; 47}$ so that $H_{0.3}$ is accepted, which means that there is no interaction effect between the learning model and Learning independence towards mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year.

Based on the ANAVA test, the first hypothesis is obtained $F_{obs}$ (A) = 8.601275 and $F_{0.05;1;47}$= 4.03 at a significant level of 5% degrees of freedom = 1 then $F_{obs}$ (A) > F0.05; 1; 47 so that the first hypothesis has been tested with $H_{0.1}$ rejected. This shows the learning model's effect on mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year. The results of this study are in line with the research conducted by Halisma Mente and La Ode Ahmad Jazuli (2014), which states that the knowledge obtained from the Problem Based Learning (PBL) model will be understood more deeply and hard to forget, giving students a broader view of towards success, train students to learn more independently and provide opportunities for students to work in their way.

The second hypothesis is obtained $F_{obs}$ (B) = 23.64841 and $F_{0.05; 1; 47}$ = 4.03 at a significant level of 5% degrees of freedom = 1 then $F_{obs}$ (B) > $F_{0.05; 1; 47}$ so that the second hypothesis has tested with $H_{0,2}$ rejected. This shows independent learning on mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year. The results of this study are by the research of Titin Kurnia Bungsu et al. (2014), which states that independence is something that plays an important role in learning, especially mathematics learning; this is because learning independence is the ability of students to carry out learning activities with their encouragement and without coercion. Learning independence also plays a role in maximizing mathematics learning outcomes.

The third hypothesis is obtained, obtained by $F_{obs}$ (AB) = 3.056467 and $F_{0.05; 1; 47}$ = 4.03 at the significant level of 5% degrees of freedom = 1 then $F_{obs}$ (AB) < $F_{0.05;1;47}$ so that the third hypothesis has been tested with $H_{0,3}$ accepted. This shows no influence of the learning model's interaction and learning independence on mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year.

According to Kerlinger in Rosdiana et al. (2012-22), the attraction is a collaboration of two or more variables in influencing a dependent variable. There are independent variables in this study, namely learning models and independent learning. In contrast, the dependent variable is mathematics learning outcomes. According to Wahyu Widhiarso (2011), interaction is a phenomenon that occurs in the case of factorial ANAVA, which shows that the pattern of each factor being tested is different. These different patterns will be easily understood by crossing lines on the graph. Craft the following image:
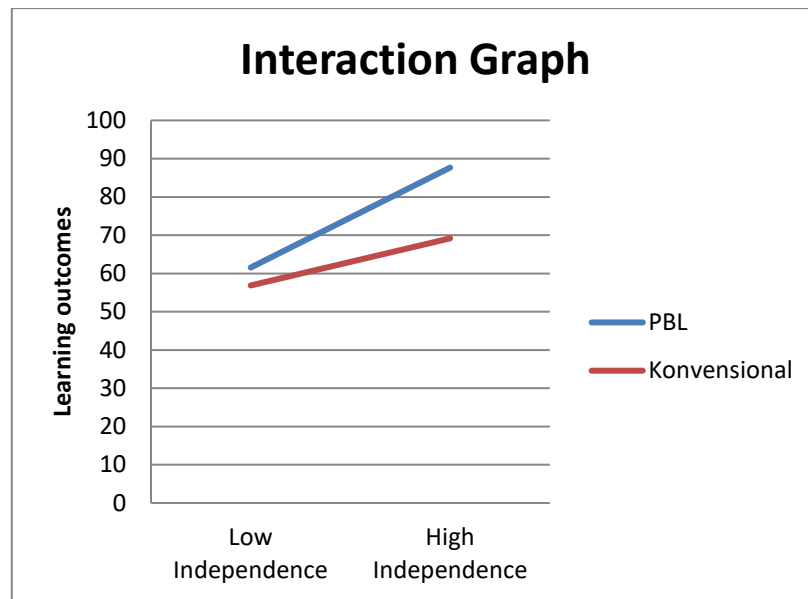
**Figure 1.** Interaction Graph Images

Based on the picture above, it can be described that there is no interaction between the learning model and the independence of learning outcomes because there are no visible intersections or cross lines shown on the graph. If the first independent variable's profiles and the second independent variable do not intersect, there is no interaction (Budiyono, 216: 222). Several possibilities cause no interaction between learning models and independent learning on mathematics learning outcomes, including students who still have difficulty learning in the learning process or difficulty working on the questions given. Both students and researchers have not had meaningful cooperation to support research.

**CONCLUSION**

Based on data analysis and discussion of this research, it is possible concluded that:

1. There is a significant effect of the learning model on mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year. This is indicated by the results of the hypothesis test with a significant level of 5% and degrees of freedom = 1, obtained $F_{obs}$ (A) = 8.601275 and $F_{0.05; 1; 47}$ = 4.03, consequently $F_{obs}$ (A)> $F_{0.05; 1; 47}$ so that $H_{0.1}$ is rejected and $H_{1.1}$ is accepted.

2. There is a significant effect of independent learning on mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year. This is indicated by the results of hypothesis testing with a significant level of 5% and degrees of freedom = 1, obtained $F_{obs}$ (B) = 23.64841 and $F_{0.05; 1; 47}$ = 4.03, consequently $F_{obs}$(B)> $F_{0.05; 1; 47}$ so that $H_{0,2}$ is rejected and $H_{1,2}$ is accepted.

3. There is no significant effect of the interaction between the learning model and learning independence on mathematics learning outcomes in class VIII students of SMP Muhammadiyah 3 Yogyakarta even semester of the 2019/2020 academic year. This is indicated by the results of hypothesis testing with a significant level of 5% and degrees of freedom = 1, obtained $F_{obs}$ (AB) = 3.056467 and $F_{0.05; 1; 47}$ = 4.03 consequently $F_{obs}$ (AB) <$F_{0.05; 1; 47}$ so that $H_{0.3}$ is accepted and $H_{1.3}$ is rejected.

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