# THE CORRELATION BETWEEN LEARNING INDEPENDENCE, NUMERICAL ABILITY, AND LEARNING MOTIVATION IN MATHEMATICS LEARNING OUTCOMES

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**ABSTRACT**

Low student Mathematics learning Outcomes are associated with many factors. Learning independence, numerical ability, and motivation to learn are three factors that are suspected of correlating with mathematics learning outcomes Student. This study is purposed to determine whether or not a positive and significant correlation between Learning Independency, Numerical Ability, and learning Motivation in Mathematics Learning Outcomes Student in Grade VIII Junior High School (SMP) Muhammadiyah 1 Godean Sleman even Semester Academic Year of 2017/2018. This research population was all students grade VIII SMP Muhammadiyah 1 Godean Sleman in odd Semester academic year 2017/2018 consisting of 5 classes with 169 students. Sampling class using a random sampling technique to class, which obtained class VIII B as sample class and class VIII E as a trial class. This research using a random sampling technique. Data collection techniques were conducted by questionnaire and test methods. The data collection instrument uses a learning independence questionnaire, numerical ability test, learning motivation questionnaire, and learning outcomes test. The instrument test uses a validation test, a discrimination test, and a reliability test. The prerequisite analysis test uses the normality test, independence test, and linearity test. Data analysis for hypothesis testing using simple linear regression analysis and multiple regression and correlation analysis. The result showed a positive and significant correlation between learning independence, numerical ability, and learning motivation in mathematics learning outcomes with $F_{count} = 6{,}827 > F_{table} = 2{,}92$, double correlation coefficient (R) 0,637, and double determination coefficient $(R^2)$ equal to 0,406. While the double regression equation $\hat{Y} = -60{,}105956 + 0{,}184X_1 + 0{,}306X_2 + 1{,}083X_3$, the relative contribution $(X_1) = 9{,}836\%$, the relative contribution $(X_2) = 12{,}786\%$, the relative contribution $(X_3) = 77{,}378\%$, and effective contribution $(X_1) = 3{,}991\%$, effective contribution $(X_2) = 5{,}187\%$, and effective contribution $(X_3) = 31{,}394\%$.
**Keywords**: independence, numerical ability, motivation.

## INTRODUCTION

Education is the most important role for every nation, especially a developing nation like Indonesia. To build a developing nation, high-quality human resources are needed. All that will be achieved if the education has been going well and of high quality. Education is also one of the efforts in answering problems and various challenges that are always present amid human life. Therefore, every individual involved in the education process must play a leading role in improving education quality.

Indonesia is one of the world's developing countries that is still lagging behind its human resources quality. In connection with efforts to prepare quality human resources, the Republic of Indonesia's government has given considerable attention to the world of education by trying hard to improve national education quality. Education is a conscious and planned effort to create an atmosphere of learning and the learning process. Students actively develop their potential to have spiritual strength, self-control, personality, intelligence, noble character, and the skills shown by themselves, society, nation, and state. (Law on the national education system No.20 of 2003 article 1).

Education can be pursued through three education channels, namely formal, informal, and non-formal education. This study focused on formal education in schools because it is one element in achieving national education goals.

One way to improve the quality of education that can be done is to improve mathematics learning quality. Mathematics is given at all levels of education, starting from elementary school to high school. The process of teaching and learning mathematics always involves students actively developing the ability to reason critically and creatively. However, in reality, many students at every level of education consider mathematics a tedious and challenging subject, so they are less enthusiastic about following mathematics. As a result, the results of learning mathematics obtained are low.

Based on interviews with students, some students still think that mathematics is a difficult subject. Besides that, many factors influence the level of student learning outcomes. This can be seen from the Midterm Semester results (PTS) value even in the 2016/2017 school year VIII grade mathematics subjects at SMP Muhammadiyah 1 Godean.

**Table 1.** Average Assessment Rate of even Semester Semester Subjects in Mathematics for Class VIII SMP Muhammadiyah 1 Godean 2016/2017 Academic Year

| No | Class | Total students | MCC | Average | < MCC | ≥ MCC |
|---|---|---|---|---|---|---|
| 1 | A | 35 | 70 | 42 | 31 | 4 |
| 2 | B | 34 | 70 | 44 | 28 | 6 |
| 3 | C | 32 | 70 | 28 | 30 | 2 |
| 4 | D | 34 | 70 | 38 | 32 | 2 |
| 5 | E | 34 | 70 | 32 | 33 | 1 |

(Source Data: SMP Muhammadiyah 1 Godean)

Table 1 shows that the results of private mathematics class VIII SMP Muhammadiyah 1 Godean are still not optimal. Most students still have not reached the Minimum Completeness Criteria (MCC).

Based on an interview with a mathematics teacher at SMP Muhammadiyah 1 Godean on April 28, 2017, some information was obtained. Most of the students still had difficulty understanding mathematics subject matter. Students must repeatedly repeat the lesson, so students understand the material. Also, the independence of students learning mathematics in following the lessons is still low. This is indicated when following the learning process of students who tend to be passive and do not have the passion for trying with their abilities. Some of them are also just waiting for their friends who are smarter if given the task. They are also not serious in learning, such as lack of initiative to work on the teacher's practice questions.

Other information obtained from the interview revealed that some students still experience difficulties in counting or operating numbers. So that students have difficulty when doing math tests because mathematics is associated with numbers or numbers. The latest information obtained from the interview, namely the lack of student motivation. When the teacher explained the material in front of the class, some students chatted with friends beside him rather than pay attention to the lesson. If given the assignment to do at home, most students did not do it.

## METHODS

This research is classified as quantitative research. Quantitative research methods can be interpreted as research methods based on positivism, used to examine populations or individual samples. Sampling techniques are generally carried out randomly, collecting data using quantitative/statistical data analysis research instruments to test established hypotheses (Sugiono 2014: 14). The following research designs were carried out in Figure 1.

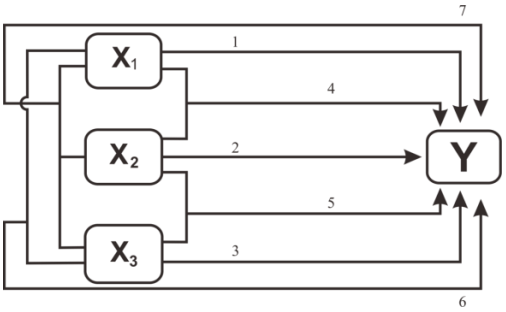


**Figure 1.** Relationship between the independent variable and the dependent variable

This research was conducted in class VIII SMP 1 Muhammadyah Godean Sleman Regency odd semester of 2017/2018. This study's population was students of class VIII SMP 1 Muhammadyah Godean, with 169 students divided into five classes. The sampling technique in this study was a random sampling technique for class. Sampling is done by lottery class. The class taken as a sample class is class VIII B. In this study, four variables are consisting of 3 independent variables, namely learning independence ($X_1$), numerical ability ($X_2$), learning motivation ($X_3$), and one dependent variable, namely learning outcomes (Y). In this study, data collection techniques were the questionnaire method (an instrument of learning independence and learning motivation) and the test method (an instrument of numerical ability and learning outcomes).

In this study, the class taken as a test class is class VIII E. The test instruments used in this study were the validity test, the difference power test, and the reliability test. Data analysis technique:

1. Analysis of descriptive data
2. Testing the analyst prerequisites: Normality test, Linearity test, and Independence Test
3. Test the hypothesis

**RESULTS AND DISCUSSION**

Learning independence of VIII grade students of SMP Muhammadiyah 1 Godean, Sleman Regency in the odd semester of the academic year 2017/2018 is included in the medium category because the most significant frequency lies in the interval $69{,}228 \leq X \leq 89{,}89$, namely as many as 22 students or 64.70%.

The numerical ability of Grade VIII students of SMP Muhammadiyah 1 Godean, Sleman Regency in the odd semester of the academic year 2017/2018 is included in the medium category because the most significant frequency lies in the interval of $58{,}063 \leq X \leq 75{,}847$, namely as many as 20 students or 58.83%.

The learning motivation of eighth-grade students of SMP Muhammadiyah 1 Godean, Sleman Regency in the odd semester of the academic year 2017/2018 is included in the medium category because the most significant frequency lies in the interval $666{,}293 \leq X \leq 88{,}825$, namely 19 students or 55.88%.

Mathematics learning outcomes of VIII grade students of SMP Muhammadiyah 1 Godean, Sleman Regency in the odd semester of the academic year 2017/2018 are included in the low category because the highest frequency lies in the interval $X < 70$, as many as 26 students or 76.47%.

The summary of normality test results can be seen in Table 5.

**Table 5.** Summary of Normality Test Results

| Variable | $\chi^2_{count}$ | $\chi^2_{table}$ | dk | Info. |
|---|---|---|---|---|
| $X_1$ | 1,840 | 9,4877 | 4 | Normal |
| $X_2$ | 3,140 | 7,8147 | 3 | Normal |
| $X_3$ | 1,324 | 7,8147 | 3 | Normal |
| Y | 4,081 | 5,9915 | 2 | Normal |

From the normality test at a significant level of 5%, it is seen $\chi^2_{count} \leq \chi^2_{table}$. This means that the distribution of data obtained on each variable is normally distributed.

The summary of independent test results can be seen in Table 6.

**Table 6.** Summary of Independence test results

| Variable | $\chi^2_{count}$ | $\chi^2_{table}$ | Info. |
|---|---|---|---|
| $X_1$ and $X_2$ | 27,338 | 37,6525 | Independent |
| $X_1$ and $X_3$ | 33,691 | 37,6525 | Independent |
| $X_2$ and $X_3$ | 21,402 | 37,6525 | Independent |

From the independent test at a significant level of 5% and the degree of freedom $(dk) = (\mathrm{k}-1)(\mathrm{b}-1)$, we can see $\chi^2_{count} \leq \chi^2_{table}$. This means that the distribution of data obtained on each variable is mutually independent.

The summary of linearity test results can be seen in Table 7.

**Table 7.** Summary of Linearity Test Results

| Variable | $F_{count}$ | $F_{table}$ | Info. |
|---|---|---|---|
| $X_1$ with Y | 0,964 | 2,41 | Linear |
| $X_2$ with Y | 1,059 | 2,57 | Linear |
| $X_3$ with Y | 0,979 | 2,75 | Linear |

From the linearity test at the 5% significance level and the degree of freedom of the numerator $(v_1) = \mathrm{k}-2$ and the denominator $(v_2) = n-k$ we can see $F_{count} \leq F_{table}$This means a linear relationship between the independent variables ( X) and the dependent variable (Y).

a. Testing the first hypothesis: $t_{count} = 2{,}242 > t_{table} = 1{,}6939$
So that $H_{0,1}$ is rejected and $H_{1,1}$ is accepted, so there is a positive and significant relationship between learning independence and mathematics learning outcomes of VIII grade students of SMP Muhammadiyah 1 Godean Sleman in the odd semester of 2017/2018.

b. Testing the second hypothesis: $t_{count} = 2{,}033 > t_{table} = 1{,}6939$
So that $H_{0,2}$ is rejected and $H_{1,2}$ is accepted, so there is a positive and significant relationship between numerical ability and mathematics learning outcomes of students of class VIII of SMP Muhammadiyah 1 Godean Sleman in the odd semester of the academic year 2017/2018.

c. Third hypothesis testing: $t_{count} = 3{,}228 > t_{tab}le = 1{,}6939$
So that $H_{0,3}$ is rejected, and $H_{1,3}$ is accepted. Hence, there is a positive and significant relationship between learning motivation and mathematics learning outcomes of VIII grade students of SMP Muhammadiyah 1 Godean Sleman in the odd semester of the academic year 2017/2018.

d. Testing the fourth hypothesis: $F_{count} = 3{,}583 > F_{table} = 3{,}30$
So that $H_{0,4}$ is rejected, and $H_{1,4}$ is accepted. Hence, there is a positive and significant relationship between learning independence and numerical ability with mathematics learning outcomes of VIII grade students of SMP Muhammadiyah 1 Godean, Sleman regency odd semester of the academic year 2017/2018.

e. Testing the fifth hypothesis: $F_{count} = 5{,}719 > F_{table} = 3{,}30$
So that $H_{0,5}$ is rejected, and $H_{1,5}$ is accepted. Hence, there is a positive and significant relationship between learning independence and learning motivation with mathematics learning outcomes of Grade VIII students of SMP Muhammadiyah 1 Godean Sleman in the odd semester of 2017/2018.

f. Testing the sixth hypothesis: $F_{count} = 5{,}390 > F_{table} = 3{,}30$
So that $H_{0,6}$ is rejected, and $H_{1,6}$ is accepted. Hence, there is a positive and significant relationship between numerical ability and learning motivation with mathematics learning outcomes of VIII grade students of SMP Muhammadiyah 1 Godean in the Sleman odd semester of the academic year 2017/2018.

g. Testing the seventh hypothesis: $F_{count} = 6{,}827 > F_{table} = 2{,}92$

So that $H_{0,7}$ is rejected, and $H_{1,7}$ is accepted. Hence, there is a positive and significant relationship between learning independence, numerical ability, and learning motivation with mathematics learning outcomes of VIII grade students of SMP Muhammadiyah 1 Godean, Sleman regency odd semester of the academic year 2017/2018.

The results obtained are a positive and significant relationship between learning independence, numerical ability, and learning motivation with mathematics learning outcomes of VIII grade students of SMP Muhammadiyah 1 Godean, Sleman in the odd semester of the academic year 2017/2018. The following discussion regarding the results of the study:

1. The first hypothesis test result is that there is a positive and significant relationship between learning independence and mathematics learning outcomes. From this study obtained a simple correlation coefficient ($r$) learning independence ($X_1$) with mathematics learning outcomes (Y) of 0.394 at a significant level of 5%, so the determinant coefficient ($r^2$) of 0.1551258 can be explained which can be explained that 15.51% of learning outcomes are related to learning independence. In contrast, the rest are related to other factors. The existence of variance in mathematics learning outcomes (Y) can be explained by learning independence ($X_1$) through a linear line $\hat{Y} = 23{,}143 + 0{,}456X_1$. This means that each increase in one unit $X_1$ results in a 0.456 increase in Y. According to Ni kadek lia wulandari and I Wayan sudiarsa in his journal (2016: 38), there is a significant relationship between learning independence and mathematics learning outcomes of grade X students of SMA Negeri 1 Sukawati in the 2015/2016 Academic Year with $F_{regresion}$ = 7.52. This study found a positive correlation between learning independence with mathematics learning outcomes of class X students of SMA Negeri 1 Sukawati by 0.31. This means that the higher the level of students' learning independence, the higher the mathematics learning outcomes of grade X students of SMA Negeri 1 Sukawati in the 2015/2016 Academic Year. Learning independence helps students to achieve satisfying mathematical learning outcomes. The contribution of learning independence towards mathematics learning outcomes of class X students of SMA Negeri 1 Sukawati in the 2015/2016 Academic Year was 9.6%.
2. The second hypothesis test result is a positive and significant relationship between numerical ability and mathematics learning outcomes. From this study obtained a simple correlation coefficient (r) numerical ability ($X_2$) with mathematics learning outcomes (Y) of 0.338 at a significant level of 5%, so the determinant coefficient ($r^2$) of 0.1143642 can be explained which can be explained that 11, 44% of learning outcomes relate to numerical ability. In contrast, the rest relate to other factors. The existence of variance in mathematics learning outcomes (Y) can be explained by numerical ability ($X_2$) through linear lines $\hat{Y} = 30{,}712 + 0{,}429X_2$. This means that every increase in one unit of $X_2$ results in a 0.429 increase in Y.
3. The third hypothesis test result is that there is a positive and significant relationship between learning motivation and mathematics learning outcomes. From this study obtained a simple correlation coefficient (r) learning motivation ($X_3$) with mathematics learning outcomes (Y) of 0.496 at a significant level of 5%, so the determinant coefficient ($r^2$) of 0.245591 can be explained which can be explained that 24, 56% of learning outcomes relate to learning motivation. In contrast, the rest relate to other factors. The existence of variance in mathematics learning outcomes (Y) can be explained by learning motivation ($X_3$) through a linear line $\hat{Y} = 17{,}373 + 0{,}504X_3$. This means that every increase in one unit of $X_3$ results in a 0.504 increase in Y.

   According to Indra adhitama in his journal (2014: 370) that "There is a positive and significant relationship between motivation and mathematics learning outcomes of class VII State Junior High School 3 Jetis Bantul Regency Even Semester Academic Year 2013/2014. This is indicated by $t_{count} = 1{,}825 > t_{table} = 1{,}6973$ with a simple correlation coefficient (r) between learning motivation ($X_1$) with learning outcomes (Y) of 0.63159534 + 0.5629062065 $X_1$".
4. The fourth hypothesis test result is a positive and significant relationship between learning independence and numerical ability with mathematics learning outcomes. From this study, a double correlation coefficient ($R$) was obtained between learning independence ($X_1$) and numerical ability

($X_2$) with mathematics learning outcomes (Y) of 0.433 at a significant level of 5%, so that a determinant coefficient ($R^2$) of 0 was obtained, 1877691 which can be explained that 18.78% of learning outcomes are related to learning independence and numerical ability. In contrast, the rest are related to other factors. The independence of learning can explain the existence of variance in mathematics learning outcomes (Y) ($X_1$) and numerical ability ($X_2$) through linear lines $\hat{Y} = 14{,}328 + 0{,}351X_1 + 0{,}257X_2$. This means that every increase of one unit $X_1$ results in a 0.351 increase in Y, and an increase in one unit $X_2$ resulted in a 0.257 increase in Y. As for the relative contribution of $X_1$ by 63.590% and $X_2$ by 36.410%, as well as the effective contribution of $X_1$ by 11.940% and $X_2$ by 6.837%.

5. The fifth hypothesis test results show a positive and significant relationship between learning independence and learning motivation with mathematics learning outcomes. From this study, a double correlation coefficient ($R$) was obtained between learning independence ($X_1$) and learning motivation ($X_3$) with mathematics learning outcomes (Y) of 0.519 at a significant level of 5%, so that a determinant coefficient ($R^2$) of 0 was obtained, 2695102 which can be explained that 26.95% of learning outcomes are related to learning independence and learning motivation. In contrast, the rest are related to other factors. The independence of learning can explain the existence of variance in mathematics learning outcomes (Y) ($X_1$) and degree of motivation ($X_3$) through a linear line $\hat{Y} = 8{,}772 + 0{,}211X_1 + 0{,}434X_3$. This means that each increase of one unit $X_1$ results in an increase in Y of Y and an increase in Y one unit $X_3$ resulted in 0.434 increase in Y. As for the relative contribution of $X_1$ by 26,656% and $X_3$ by 73,344%, and the effective contribution of $X_1$ by 7,184% and $X_3$ by 19,767%.
6. The sixth hypothesis test results show a positive and significant relationship between numerical ability and learning motivation with mathematics learning outcomes. From this study, a multiple correlation coefficient ($R$) between numerical ability ($X_3$) and learning motivation ($X_3$) and mathematics learning outcomes (Y) was 0.508 at a significant level of 5%, so that a determinant coefficient ($R^2$) of 0 was obtained, 2580071 which can be explained that 25.8% of learning outcomes are related to numerical ability and learning motivation. In contrast, the rest are related to other factors. The existence of variance in mathematics learning outcomes (Y) can be explained by numerical ability ($X_2$) and learning motivation ($X_3$) through linear lines $\hat{Y} = 11{,}801 + 0{,}162X_2 + 0{,}472X_3$. This means that every increase in one unit of $X_2$ results in an increase in Y16 and an increase in Y one unit $X_3$ resulted in 0.472 increase in Y. While for relative contributions, $X_2$ amounted to 16,710% and $X_3$ amounted to 83,290% and effective contributions $X_2$ amounted to 4,311% and $X_3$ amounted to 21,489 /%.
7. The seventh hypothesis test results show a positive and significant relationship between learning independence, numerical ability, and learning motivation with mathematics learning outcomes. From this study, a double correlation coefficient ($R$) was obtained between learning independence ($X_1$), numerical ability ($X_2$), and learning motivation ($X_3$) with mathematics learning outcomes (Y) of 0.637 at a significant level of 5%. So the determinant coefficient obtained ($R^2$) of 0.4057247 can be explained that 40.57% of learning outcomes are related to learning independence, numerical ability, and learning motivation. In contrast, the rest are related to other factors. There is a variance in mathematics learning outcomes (Y), which can be explained by this independence of learning ($X_1$), numerical ability ($X_2$), and learning motivation ($X_3$) through linear lines $\hat{Y} = -60{,}105956 + 0{,}184X_1 + 0{,}306X_2 + 1{,}083X_3$ means that each increase in one unit $X_1$ results in 0.184 increase in Y, an increase in one unit $X_2$ results in 0.306 increase in Y and an increase in one unit $X_3$ results in 1,083 increase in Y. While for relative contribution $X_1$ is 9,8365% relative contribution $X_2$ is 12,786% and relative contribution $X_3$ is 77,378% and effective contribution $X_1$ by 3,991%, effective contribution $X_2$ by 5,187% and effective contribution $X_3$ by 31,394%

**CONCLUSION**

Based on the results of research and discussion, the following research conclusions can be drawn:

1. There is a positive and significant relationship between learning independence with mathematics learning outcomes in class VIII SMP Muhammadiyah 1 Godean Sleman district odd semester of 2017/2018. This is evidenced by the results of calculations with the t-test, which shows that the magnitude of $t_{count} > t_{table}$ is $0.2.424 > 1.6939$ with a simple correlation coefficient (*r*) of 0.394 and the linear regression equation $\hat{Y} = 23{,}143 + 0{,}456X_1$.
2. There is a positive and significant relationship between numerical ability and mathematics learning outcomes of VIII grade of SMP Muhammadiyah 1 Godean, Sleman district in the odd semester of the academic year 2017/2018. This is evidenced by the results of calculations with the t-test, which shows that the $t_{count} > t_{table}$ is $2.003 > 1.6939$ with a simple correlation coefficient (*r*) of 0.338 and a linear regression equation $\hat{Y} = 30{,}712 + 0{,}429X_2$.
3. There is a positive and significant relationship between learning motivation with mathematics learning outcomes in class VIII of Muhammadiyah 1 Godean Junior High School in Sleman district in the odd semester of the academic year 2017/2018. This is evidenced by the results of calculations with the t-test, which shows that the $t_{count} > t_{table}$ is $3.228 > 1.6939$ with a simple correlation coefficient (*r*) of 0.496 and a linear regression equation $\hat{Y} = 17{,}373 + 0{,}540X_3$.
4. There is a positive and significant relationship between learning independence and numerical ability with mathematics learning outcomes in class VIII SMP Muhammadiyah 1 Godean Sleman district odd semester of 2017/2018. This is evidenced by the results of calculations with the F-test, which shows that the size of $F_{count} > F_{table}$ is $3.583 > 3.30$ with a double correlation coefficient (*R*) of 0.433 and a linear regression equation $\hat{Y} = 14{,}328 + 0{,}351X_1 + 0{,}257X_2$. The contribution of $X_1$ relative contribution was 63.590%, and $X_2$ was 36.410%, and the effective contribution of $X_1$ was 11.940%, and $X_2$ was 6.837%.
5. There is a positive and significant relationship between learning independence and learning motivation with mathematics learning outcomes in class VIII SMP Muhammadiyah 1 Godean Sleman district odd semester of 2017/2018. This is evidenced by the results of calculations with the F-test, which shows that the size of $F_{count} > F_{table}$ is $5.719 > 3.30$ with a double correlation coefficient (*R*) of 0.519 and a linear regression equation $\hat{Y} = 8{,}772 + 0{,}211X_1 + 0{,}434X_3$. The relative contribution of $X_1$ was 26,656%, and $X_3$ was 73,344%, and the effective contribution of $X_1$ was 7,184%, and $X_3$ was 19,767%.
6. There is a positive and significant relationship between numerical ability and learning motivation with mathematics learning outcomes in class VIII SMP Muhammadiyah 1 Godean Sleman district odd semester of 2017/2018. The F-test calculations evidence these results are showing that the large $F_{count} > F_{table}$ is $5.390 > 3.30$ with a double correlation coefficient (*R*) of 0.508 and a linear regression equation $\hat{Y} = 11{,}801 + 0{,}162X_2 + 0{,}472X_3$. The relative contribution of $X_2$ was 16.710%, and $X_3$ was 83.290%, and the effective contribution of $X_2$ was 4.311%, and $X_3$ was 21.448%.
7. There is a positive and significant relationship between learning independence, numerical ability, and learning independence with mathematics learning outcomes of class VIII SMP Muhammadiyah 1 Godean Sleman district odd semester of the academic year 2017/2018. This is evidenced by the results of the F-test calculations showing that the large $F_{count} > F_{table}$ is $6.827 > 2.92$ with a double correlation coefficient (*R*) of 0.637 and a linear regression equation $\hat{Y} = -60{,}105956 + 0{,}184X_1 + 0{,}306X_2 + 1{,}083X_3$ with the coefficient of determination ($R^2$) of 0.4057247. The relative contribution of $X_1$ was 9.836%, the relative contribution of $X_2$ was 12.7867%, and the relative contribution of $X_3$ was 77.387%. The effective contribution was 3.991%, the effective contribution was 5.187%, and the effective contribution was 31.3394%.

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