PREDICTION OF STUDENT ACHIEVEMENT BASED ON PARENTAL INCOME AND ATTENDANCE OF CLASS IX STUDENTS USING MULTIPLE LINEAR REGRESSION METHOD

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Abstract

This study aims to predict student achievement based on parental income and attendance. This study uses a quantitative approach with the population included all ninth grade students at SMP Swasta YP Utama Medan and the sample taken was 25 students. This study used instruments in the form of questionnaires and documentation. Data analysis used multiple linear regression to predict student academic achievement based on the variables of parental income and attendance. Prediction of students' achievement in grade IX at SMP Swasta YP Utama Medan based on parents' income and attendance patterns resulted in a Multiple Linear Regression equation that shows a positive relationship between economic conditions, students' attendance patterns and students' academic achievement. The accuracy level of prediction of student academic achievement based on parental income and attendance patterns shows that there are 16% of students getting excellent and 84% of students getting good grades.

Keywords: Prediction, Achievement, Multiple Linear Regression

Abstrak

This research aims to analyze and apply technology with a differentiated approach in the social emotional development of students in mathematics learning at SMA Negeri 3 Medan. The research method used was Classroom Action Research which was carried out in two cycles. The research subjects were class XI students at SMA Negeri 3 Medan. Each cycle consists of planning, implementation, observation, and reflection. This class was chosen because it is a good representation of the general high school student population. The instruments used are questionnaires and learning outcomes tests. The research results show that the application of technology with a differentiated approach in mathematics learning, especially in compound interest material, not only increases students' cognitive understanding but also has a positive impact on the social emotional development of students at SMA Negeri 3 Medan. This approach not only helps students better understand math concepts, but also encourages the development of social and emotional skills that are important for their future success. With technology as a supporting tool, education becomes more personalized, adaptive and effective, producing students who are better prepared to face academic and life challenges.

Kata Kunci: *Prediksi, Prestasi, Regresi Linier Berganda*

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INTRODUCTION

Student learning achievement is an important indicator of success in education. Learning achievement based on the large Indonesian dictionary is the result of an activity indicated by the value given by the educator. According to M. Suryanto, learning achievement is the result of learning obtained from the educational process carried out by educational institutions and expressed by grades (WIDYASTUTI, 2023)

Each student has different skills and abilities so that different guidance is needed from educators. Based on this, it is necessary to know early about the level of student achievement so that educators can provide guidance and pursuit in accordance with student abilities (Hutagalung, 2023). Learning achievement certainly has factors that influence it, both internal factors such as motivation and interest of students and external factors such as economic conditions, family environment and patterns of student attendance at school. Economic conditions such as parental income and school attendance patterns have a significant role in determining student achievement.

The economic condition factor of parents shows their financial ability. Economic conditions are included in family environment factors, different economic conditions will affect learners' learning activities. The learning resources offered to learners will depend heavily on their financial capabilities, ensuring that they have access to the infrastructure and resources they need to improve their academic performance (Kusumastuti, 2020). Learners who come from better economic conditions will have easier access to learning facilities that can later improve their learning achievement. Meanwhile, learners with low economic conditions can experience limitations in accessing quality educational facilities.

In addition to the economic condition factor, student attendance patterns also play an important role in determining student academic achievement. If students have consistent attendance, this means that students are directly involved in teaching and learning activities. Learners who have a high attendance pattern tend to have a better understanding of learning while students with low attendance patterns make it difficult for students to understand learning, resulting in inhibition of the development of their academic achievement (Jojor, 2022).

Often called a forecast, a prediction is an estimate or approximation of a future event or potential occurrence. Forecasts and predictions can be qualitative or quantitative. Making qualitative predictions is challenging because the factors are very relative. Point predictions and interval predictions are two types of quantitative predictions. A single forecast includes only one value, but an interval prediction, which is often bounded by a lower bound or a lower and upper bound prediction, contains many values (Pangestu, 2022).

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Based on KBBI, learning achievement is the understanding/mastery of knowledge or skills obtained from learning, and is usually assessed by test results or grades from teachers. Meanwhile, M. Suryanto stated that learning achievement measured by grades is the total ability obtained during the education process. In higher education, the achievement index (IP) is a numeric value that represents student learning achievement. The value obtained by students after attending lectures for one semester is known as the achievement index (Defiyanti, 2013). Both internal and environmental factors affect how well students learn. While internal causes come from within the student, external effects come from outside the student (Wahyuni, 2021).

Economic variables also have an impact on the existence of social capital. When considering other elements, such as social capital, economic variables play a significant role. As a result, characteristics such as income, standard of living, occupation, and property ownership indicate how much society values or rewards a person for his or her social status. Kiribakka further stated that economic considerations play an important role in identifying individuals with high and low social capital. Based on their economic circumstances, everyone is categorized into different social classes. People can access various public resources, including health and education, to improve their quality of life when economic variables are high. However, social capital and education are interrelated. Downing (Suroto, 2024) states that high levels of education are associated with high social capital.

Discipline is acting in an orderly manner and obeying rules and guidelines. Because learning is closely related to psychology (psychology), discipline can improve learning outcomes, as stated by Mohamad Mustari (Munte, 2022). Nature of Discipline: Teachers can use it to evaluate their students because discipline is defined as a person's loyalty and obedience to behavioral regulations determined by the norms that apply in an institution (Pradita, 2022).

Risnaeani Chasanah (2014: 103-104) defines discipline as a value related to the order and regularity of students at school. This can be measured in the following ways: a. On time. b. Can calculate how long it takes to complete an assignment. c. Utilizing items according to their intended use. d. Taking items and returning them to their original place. e. Taking items and returning them to their original place. f. Taking items and returning them to their original place. g. Trying to follow the established guidelines. h. Waiting for your turn in line. Waiting for your turn in sequence. g. Understanding the impact of not practicing discipline (Iftitah, 2023).

One technique to find out the relationship between one or more independent variables with one or more dependent variables is to use linear regression. Simple linear regression refers to a model with only one independent variable, while multiple linear

regression refers to a model with several independent variables (Magfirah, 2019). Analyzing the linear relationship between dependent and independent factors using outcome, dependent, and dependent variables is known as linear regression. One method for determining the interaction between these variables is regression analysis (Leza, 2024).

A multiple linear regression model, often known as multiple linear regression, consists of one continuous dependent variable plus k or more continuous and/or categorical independent variables. An extension of simple linear regression analysis that incorporates multiple independent variables is called multiple linear regression analysis (Irvan, 2021). The following is the general form of multiple linear regression, often known as multiple linear regression analysis:

Regression equation for population:

$y = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \varepsilon_i$ there are 2 independent variables.

$y = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki} + \varepsilon_i$ if there are k independent variables.

Regression equation for the sample:

$y = \alpha + b_1 x_{1i} + b_2 x_{2i} + e_i$ there are 2 independent variables.

$y = \alpha + b_1 x_{1i} + b_2 x_{2i} + \cdots + b_k x_{ki} + e_i$ if there are k independent variables.

By looking at the influence of parental income and attendance on learning achievement, this study aims to predict student achievement based on these two factors. The multiple linear regression method was used to measure and analyze the extent to which parental income and attendance can affect student academic achievement at SMP Swasta YP Utama Medan. It is hoped that the results of this study can provide insight for schools and parents in supporting the improvement of student academic achievement through attention to attendance factors and family economic support (Novitasari, 2018).

METHOD

This study uses a quantitative approach that aims to predict student achievement based on parental income and attendance of grade IX students at SMP Swasta YP Utama Medan. The study population included all ninth grade students at SMP Swasta YP Utama Medan and the sample taken was 25 students. This study used instruments in the form of questionnaires and documentation. Questionnaires were used to collect data on parents' income and documentation was used to obtain academic grades and student attendance from school records (Novitasari, 2018).

Data analysis used multiple linear regression to predict student academic achievement based on the variables of parental income and attendance. There are four steps that will be carried out in conducting data analysis, namely: 1) initialize the student

data into X1, X2 and Y, 2) normalize the data, 3) calculate the regression coefficient, and 4) find the regression equation (Septina, 2018). The multiple linear regression equation that will be used in this study is as follows:

$$Y = a + b_1X_1 + b_2X_2$$

Description:

Y = Student academic achievement (dependent variable)

X_1 = Parents' income

X_2 = Student attendance rate

a = Constant

b_1 and b_2 = Regression coefficient for the independent variable X_1 and X_2

Result And Discussion

Based on research conducted on October 24, 2024 in class XI of SMP Swasta YP Utama Medan, the data obtained are listed in table 1.

Table 1. Overall Data

No	Name	Parents' Income/ Month	Number of Attendance	Student Achievement (Score)
1	AS	2.500.000	100	76.4
2	AFV	4.000.000	110	82.3
3	AFH	3.000.000	103	79.6
4	ADC	3.000.000	121	81.2
5	AA	5.200.000	124	88.3
6	BH	3.500.000	112	80.5
7	BEP	4.000.000	112	82.6
8	F	2.500.000	111	78.3
9	GRJ	2.500.000	109	77.2
10	GTP	3.000.000	102	76.7
11	HR	3.500.000	110	85.3
12	LDS	3.200.000	112	75.9
13	LUN	5.200.000	113	81.3
14	MSAH	4.500.000	124	87.5
15	MF	2.800.000	120	77.4
16	NZ	5.000.000	117	76.5
17	RP	3.400.000	113	86
18	RQM	4.500.000	111	82.2

19	RY	1.950.000	113	77.6
20	RRM	3.500.000	122	82.3
21	SA	3.000.000	113	83
22	SUR	2.400.000	113	77.5
23	SA	3.000.000	111	82
24	AW	2.950.000	105	77.9
25	A	4.500.000	119	83.8

Table 1 presents the sample data obtained in the form of student names, parents' income, number of attendances and student scores. The analysis proceeds by initializing the data where X1 and X2 are independent variables and Y is the dependent variable. Because parents' income and attendance affect student achievement, it will be initialized as follows:

X1 = Parents' Income

X2 = Attendance

Y = Student Achievement

Table 2. Data Initialization

Name	X1	X2	Y
AS	2.500.000	100	76.4
AFV	4.000.000	110	82.3
AFH	3.000.000	103	79.6
ADC	3.000.000	121	81.2
AA	5.200.000	124	88.3
BH	3.500.000	112	80.5
BEP	4.000.000	112	82.6
F	2.500.000	111	78.3
GRJ	2.500.000	109	77.2
GTP	3.000.000	102	76.7
HR	3.500.000	110	85.3
LDS	3.200.000	112	75.9
LUN	5.200.000	113	81.3
MSAH	4.500.000	124	87.5
MF	2.800.000	120	77.4
NZ	5.000.000	117	76.5
RP	3.400.000	113	86
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SUR	2.400.000	113	77.5
SA	3.000.000	111	82
AW	2.950.000	105	77.9
A	4.500.000	119	83.8

After the data is initialized in table 2, the next step is to normalize the data. The average student score data collected from SMP Swasta YP Utama Medan is quite large, so it is necessary to reduce the overall data for simpler calculations. Parental income is divided by 10,000,000, the number of attendance is divided by 124, and the cumulative score of 10 subjects is divided by 100. the data is presented in table 3.

Table 3. Data Normalization

Name	X1	X2	Y
AS	0.25	0.81	0.76
AFV	0.4	0.89	0.82
AFH	0.3	0.83	0.8
ADC	0.3	0.98	0.81
AA	0.52	1	0.88
BH	0.35	0.9	0.81
BEP	0.4	0.9	0.83
F	0.25	0.9	0.78
GRJ	0.25	0.88	0.77
GTP	0.3	0.82	0.77
HR	0.35	0.89	0.85
LDS	0.32	0.9	0.76
LUN	0.52	0.91	0.81
MSAH	0.45	1	0.88
MF	0.28	0.97	0.77
NZ	0.5	0.94	0.77
RP	0.34	0.91	0.86
RQM	0.45	0.9	0.82
RY	0.195	0.91	0.78
RRM	0.35	0.98	0.82
SA	0.3	0.91	0.83
SUR	0.24	0.91	0.78
SA	0.3	0.9	0.82

AW	0.295	0.85	0.78
A	0.45	0.96	0.84

The next step is to calculate the sigma value of each variable. The Multiple Linear Regression method is a technique used to predict the connection between two or more dependent variables and their independent variables. It assesses how Y relates to X1, X2, ..., Xn in order to understand the impact of these independent variables. To forecast Y or the dependent variable, once the values of the independent variables are established, the Multiple Regression equation is applied. The actual relationship between Y and X1, X2, ..., Xn can be expressed as follows:

Y = a + b1 X1 + b2 X2 + ... + bn Xn

Where:

Y	: Dependent Variable
a	: The Constant
b1, b2	: Regression Coefficient
X1, X2	: Independent Variables

Table 4. Regression Coefficient Calculation

Name	X1	X2	Y	$X1^2$	$X2^2$	Y^2	$X1.X2$	$X1.Y$	$X2.Y$
AS	0.25	0.81	0.76	0.06	0.66	0.58	0.2	0.19	0.62
AFV	0.4	0.89	0.82	0.16	0.79	0.67	0.36	0.33	0.73
AFH	0.3	0.83	0.8	0.09	0.69	0.64	0.25	0.24	0.66
ADC	0.3	0.98	0.81	0.09	0.96	0.66	0.29	0.24	0.79
AA	0.52	1	0.88	0.27	1	0.77	0.52	0.46	0.88
BH	0.35	0.9	0.81	0.12	0.81	0.66	0.32	0.28	0.73
BEP	0.4	0.9	0.83	0.16	0.81	0.69	0.36	0.33	0.75
F	0.25	0.9	0.78	0.06	0.81	0.61	0.23	0.2	0.7
GRJ	0.25	0.88	0.77	0.06	0.77	0.59	0.22	0.19	0.68
GTP	0.3	0.82	0.77	0.09	0.67	0.59	0.25	0.23	0.63
HR	0.35	0.89	0.85	0.12	0.79	0.72	0.31	0.3	0.76
LDS	0.32	0.9	0.76	0.1	0.81	0.58	0.29	0.24	0.68
LUN	0.52	0.91	0.81	0.27	0.83	0.66	0.47	0.42	0.74
MSAH	0.45	1	0.88	0.2	1	0.77	0.45	0.4	0.88
MF	0.28	0.97	0.77	0.08	0.94	0.59	0.27	0.22	0.75
NZ	0.5	0.94	0.77	0.25	0.88	0.59	0.47	0.39	0.72
RP	0.34	0.91	0.86	0.12	0.83	0.74	0.31	0.29	0.78
RQM	0.45	0.9	0.82	0.2	0.81	0.67	0.41	0.37	0.74
RY	0.195	0.91	0.78	0.04	0.83	0.61	0.18	0.15	0.71

RRM	0.35	0.98	0.82	0.12	0.96	0.67	0.34	0.29	0.8
SA	0.3	0.91	0.83	0.09	0.83	0.69	0.27	0.25	0.76
SUR	0.24	0.91	0.78	0.06	0.83	0.61	0.22	0.19	0.71
SA	0.3	0.9	0.82	0.09	0.81	0.67	0.27	0.25	0.74
AW	0.295	0.85	0.78	0.09	0.72	0.61	0.25	0.23	0.66
A	0.45	0.96	0.84	0.2	0.92	0.71	0.43	0.38	0.81
Σ	**8.66**	**22.75**	**20.2**	**3.19**	**20.76**	**16.35**	**7.94**	**7.06**	**18.41**

1. Elimination Process of Equations

   To do the elimination, the equation obtained from the calculation of the regression coefficient is needed with the following formula:

$\Sigma y = na + b_1 \Sigma x_1 + b_2 \Sigma x_2 \dots (1)$

$\Sigma yx_1 = a\Sigma x_1 + b_1 \Sigma x_1^2 + b_2 \Sigma x_1 x_2 \dots (2)$

$\Sigma yx_2 = a\Sigma x_2 + b_1 \Sigma x_1 x_2 + b_2 \Sigma x_2^2 \dots (3)$

$20,2 = 25\,a + 8,66\,b1 + 22,75\,b2 \dots (1)$

$7,06 = 8,66\,a + 3,19\,b1 + 7,94\,b2 \dots (2)$

$18,41 = 22,75\,a + 7,94\,b1 + 20,76\,b2 \dots (3)$

   Through the process of elimination between equations, we get b_1 and b_2,

   $b_1 = \dfrac{48580}{185169} = 0,26$

   From the value of b_1, it can be seen that the value for variable X1 is positive, meaning that if the economic status or income of parents increases, there will be an increase in student achievement.

   $b_2 = \dfrac{13328}{61723} = 0,22$

   From the b2 value, it can be seen that the value for the X2 variable is positive, meaning that if the number of student attendance increases, there will be an increase in student achievement.

   Furthermore, the result of b_1 and b_2 are substituted into equation (1), so that the score of

   $a = \dfrac{96403}{185169} = 0,52$

   Thus:

   $a = 0,52$

   $b_1 = 0,26$

   $b_2 = 0,22$

2. Finding the regression equation

   Since the values of a, b_1, and b_2 have been obtained, the regression equation is:

$$Y = a + b_1 x_1 + b_2 x_2$$

$$Y = 0,52 + 0,26x_1 + 0,22x_2$$

From the regression equation above, we can already do the process of predicting student achievement. Where we define parental income as X1, attendance as X2, and Y as the score.

From the calculation results using the Multiple Linear Regression Method, it is multiplied again according to the data division in the initial data. Parent income (X1) * 10,000,000, number of attendance (X2) * 100 and average score (Y) * 100. If the score ≥ 85 then the achievement is excellent, if the score ≥ 75 then the achievement is good, if the score ≥ 60 then the achievement is sufficient and if the score < 60 then the achievement is less.

Table 5. Regression Results

No	Name	Score	Regressions	Achievements
1	AS	76.4	76.32	Good
2	AFV	82.3	81.98	Good
3	AFH	79.6	78.06	Good
4	ADC	81.2	81.36	Good
5	AA	88.3	87.52	Excellent
6	BH	80.5	80.9	Good
7	BEP	82.6	82.2	Good
8	F	78.3	78.3	Good
9	GRJ	77.2	77.86	Good
10	GTP	76.7	77.84	Good
11	HR	85.3	80.68	Good
12	LDS	75.9	80.12	Good
13	LUN	81.3	85.54	Excellent
14	MSAH	87.5	85.7	Excellent
15	MF	77.4	80.62	Good
16	NZ	76.5	85.68	Excellent
17	RP	86	80.86	Good
18	RQM	82.2	83.5	Good
19	RY	77.6	77.09	Good
20	RRM	82.3	82.66	Good
21	SA	83	79.82	Good
22	SUR	77.5	78.26	Good
23	SA	82	79.6	Good
24	AW	77.9	78.37	Good
25	A	83.8	84.82	Good

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The regression results shown in the table reveal a variation in the achievement of grade IX students. Out of the 25 students analyzed, 16% or 4 students were categorized as "Excellent" signifying outstanding academic performance and consistent achievement above the established standards. In contrast, the majority of students, comprising 84% or 21 students, fell into the "Good" category. This suggests that most students demonstrated good performance and met the expected academic standards, even though they did not attain the highest category. These findings indicate that, on the whole, the performance of Grade IX students is at an acceptable level, with only a small number of students significantly excelling (Ardiningrum, 2024).

The results of this research are in line with Pradita's (2022) findings which show that students' economic status and discipline have a positive effect on student learning achievement in vocational schools. Based on this research, higher economic status allows parents to provide better learning facilities, thereby increasing student achievement. Pradita also noted that discipline plays a significant role in improving academic achievement, which is in line with our results that increasing parental income and student attendance levels have the potential to increase academic achievement (Susilo, 2024). The results of this study are consistent with the findings of Gbadamosi ((Gifari, 2022)which shows that students' presence in class plays an important role in their academic achievement. Good attendance allows students to understand lesson material more optimally, participate actively in discussions, and receive direct guidance from teachers, all of which have a positive impact on academic achievement. Apart from that, research by Asadullah (2017) highlights that parental income also has a significant influence on the quality of education that students receive. Higher incomes enable students to access more adequate learning facilities and additional tutoring, which helps improve academic performance. Furthermore, as stated by Monks and Schmidt (Tauva, 2022), high student attendance and financial support from parents work together to create a conducive learning environment. This environment encourages better understanding and supports student academic success. Our research shows that the combination of good attendance and adequate parental income significantly supports students' academic achievement, according to the findings.

Conclusion

Predicting the achievement of 9th grade students of SMP Swasta Utama Medan based on parental income and attendance patterns of students produces a Multiple Linear Regression equation, namely:

$$Y = 0,52 + 0,26x_1 + 0,22x_2$$

The equation shows a positive relationship between economic conditions, student attendance patterns on student academic achievement. If the economic status or income

of parents increases, there will be an increase in student achievement and if the number of student attendance increases, there will be an increase in student achievement. Based on the analysis carried out, predictions of student academic achievement based on parental income and attendance show that there are 16% of students who get excellent grades and 84% of students who get good scores. If the economic status or income of parents increases, there will be an increase in student achievement and if the number of student attendance increases, there will be an increase in student achievement.

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