08 Modeling

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Modeling for anxiety data toward students achievement in factorial design materials

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Abstract. This study aims to determine various models that might occur in the relationship between anxiety and student achievement in factorial design material. At first glance, this data model is a linear regression with the correlation coefficient is negative. However, by using *Curveexpert 1.4*, some other models are mostly non-linear that might be better models than the linear model itself. This research method utilizes the Lavenberg-Marquardt method. The order of the models generated from the best models was as follows: 1) Fit Polynomial; 2) Sinusoidal fit; 3) Quadratic Fit; 4) Rational Function; 5) MMF Model; 6) User-Defined Model; 7) Linear Fit; and 8) Logistic Model.

1. Introduction

Successes of learning for a student's usually reflected in their achievement in a school. A good score of a test, of course, is a reflection of that the student success in learning. The student's conditions also affect whether the students will be a success or failure in the study. This regard, physiological conditions and psychological of the students also change. Mental conditions such as students anxiety too very influential in the process of learning. Most people experienced anxiety if they face something challenging, like learning mathematics. Especially when the material is quite complicated and complex, for instance teaching about 4 factors factorial design in the course design of experiments. Usually, the anxiety will show up when the tests will be taken. The dimensions of the concern are somatic anxiety, worry, and concentration disruption, and it showed that the three predictors could predict two out of three aspects of competitive anxiety [1]. Feelings of panic and fear of not being able to do the test become indicators that trigger student anxiety higher that will affect the test results. Hashempour & Mehrad also said that academic anxiety could have a negative impact on the success and activities of the school by themselves [2]. On the other hand, anxiety inhibits control of attention

and concentration which can have a negative impact on the range of working memory and emotional intelligence as a result of affecting inability and performance in the process of learning.

High levels of anxiety when learning on someone has an adverse impact, usually the opposite effect on one's achievement. Moreover, it happens continuously so this will have an even worse impact. This is because high anxiety means the condition of a person is not good, resulting in an unfortunate possibility. According to Herrero (2006), students who permanently show a high level of anxiety usually show poor learning and memory skills, at this point, reducing stress related to responses or lowering levels of anxiety can increase students' cognitive performance and learning ability [3].

Anxiety experienced by someone can lead to negative things in their learning process. The theory of some experts described that the fear and the learning achievement has a linear relationship, although the correlation is negative. It means that between the two is inversely proportional, namely, if learning anxiety is high, then students achievement will be low and if fear is small, then the result will be high. However, such conditions cannot be used as a first benchmark because the requirements of students differ specifically. It can be said that reality can be the same as a theory, but it could be close or even different. Therefore, in this study, we will look for the possibility of several regression modeling in addition to the linear regression model that might occur and be more near perfect between the variables of anxiety and achievements.

2. Research Methods

This mathematical modeling study has been carried out using the Lavenberg-Marquardt's method to determine non-linear regression models. The methods of research using a field approach to obtain anxiety data through questionnaires and student achievement through tests. Then the data was tested using the SPSS 16 statistical program and assisted by CurveExpert 1.4 to see the linear regression model [4] [5]. The algorithm is:

Calculate $\chi^2(a)$ (1)

Take a certain value for λ. (CurveExpert used 0.001) (2)

Get δa from equation (3)

Evaluate$\chi^2(a+\delta a)$ (4)

If $\chi^2\ (a+\delta a) \geq \chi^2(a)$, multiple λ with a factor (CurveExpert used 10) and returns to (3). (5)

If $\chi^2\ (a+\delta a) < \chi^2(a)$, divide λ by a factor (CurveExpert used 10), correct the parameter vector with $a = (a+\delta a)$and return to (3). (6)

Iteration is stopped when $\chi^2\ (a+\delta a)$- $\chi^2(a) < \varepsilon$. The tolerance of ε taken by CurveExpert 1.4 is 10-6. [6]

3. Result and Discussion

The relationship between two variables, namely between anxiety and learning achievement is an unusual relationship. The relationship formed by these two variables is an inversely proportional relationship. That is, if anxiety is higher, then the achievement will be lower and vice versa if the anxiety is lower then the achievement will be higher. This is in line with the results obtained in this study, namely in Table 1 below.

Table 1. Correlations between anxiety and achievement

achievement	Anxiety		
-.486*	1	*Pearson Correlation*	anxiety
.048		*Sig. (2-tailed)*	

17	17	*N*	
1	-.486*	*Pearson Correlation*	achievement
	.048	*Sig. (2-tailed)*	
17	17	*N*	

**. Correlation is significant at the 0.05 level (2-tailed).*

Based on the SPSS output, it shows that the correlation coefficient between anxiety variables and achievement variables is -0.486, which means that when the correlation coefficient minus shows an inverse relationship, the effect is a negative influence. When the negative impact of a variable increases will result in the decline of other variables, while a decrease in a variable can lead to a rise in the other variables that participated in this study. Based on Table 1 also obtained that the value of sig is 0.048. This significance value when compared with alpha 5%, the result is that Ho is rejected. It means the value of the correlation coefficient is significant. This is strengthened in Table 2, and the Anava results below.

Table 2. ANOVA[b]

Sig.	*F*	*Mean Square*	*Df*	*Sum of Squares*	*Model*	
.048[a]	4.644	1229.174	1	1229.174	*Regression*	1
		264.659	15	3969.885	*Residual*	
			16	5199.059	*Total*	

a. Predictors: (Constant), kecemasan

b. Dependent Variable: prestasi

The significant correlation coefficient can be interpreted that there is a linear relationship between anxiety variables and learning achievement variables even though the correlation is a negative correlation. When there is a direct relationship between the two variables means a linear model is a model that may be formed from the relationship between the two variables but does not rule out the possibility that there are still other models that might be created from the relationship between the two variables. By using CurveExpert 1.4, the software that utilizes the Lavenberg-Marquardt method, the other non-linear models that represent the relation to the two variables can be easily generated. The best model is to fulfill 3 criteria, namely (1) Viewing from Standard Error (S) which is getting closer to zero, (2) Looking at the value of the correlation coefficient that is getting closer to 1, and (3) The residual value is as small as possible where the total remaining value is positive and must be balanced. Here are the 8 best models according to the best ranking generated from CurveExpert 1.4.

3.1. *Polynomial fit*

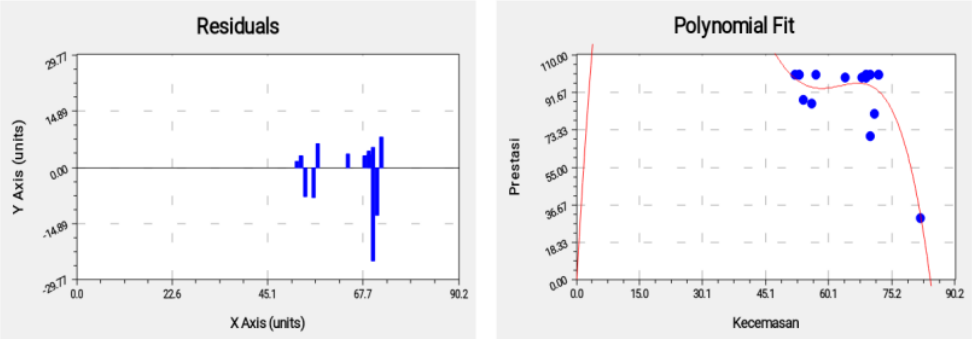

Figure 1. Regression curves and residual curves of a polynomial fit

4th Degree Polynomial Fit: $y = a + bx + cx^2 + dx^3 + ex^4$
Coefficient Data:
a = 2.24284977457E-003
b = 3.61070429500E+001
c = -1.60032168924E+000
d = 2.49192051663E-002
e = -1.30712108642E-004
Standard Error S = 9.53836379
Correlation coefficient r = 0.95364619

3.2. *Sinusoidal fit*

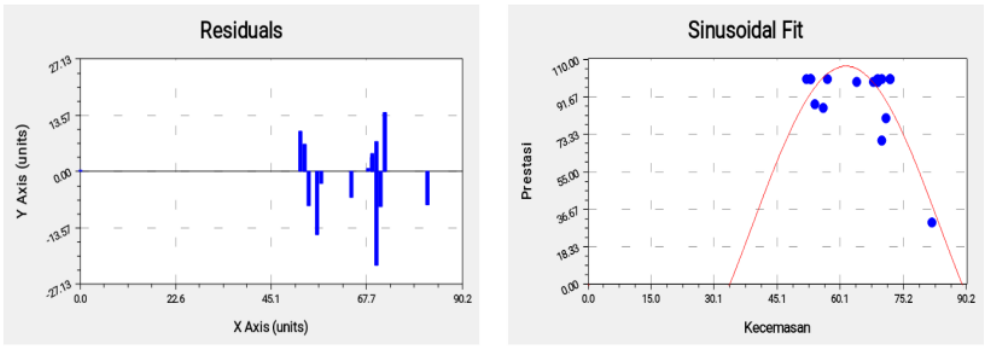

Figure 2. Regression curves and residual curves of sinusoidal fit

Sinusoidal Fit: $y = a + bcos(cx + d)$
Coefficient Data:
a = 2.89070240738E+001
b = 7.76231659411E+001
c = 7.05016851671E-002
d = -4.32694912555E+000

Standard Error S=10.93110141
Correlation coefficient r=0.93376424

3.3. Quadratic fit

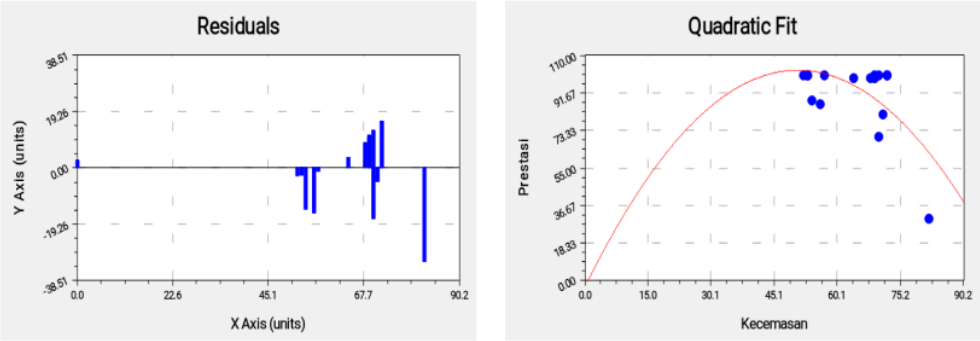

Figure 3. Regression curves and residual curves of quadratic fit

Quadratic Fit: $y = a + bx + cx^2$
Coefficient Data:
a = -2.73674898601E+000
b = 4.16727392731E+000
c = -4.11790007060E-002
Standard Error S=13.97558683
Correlation coefficient r=0.88072593

3.4. Rational function

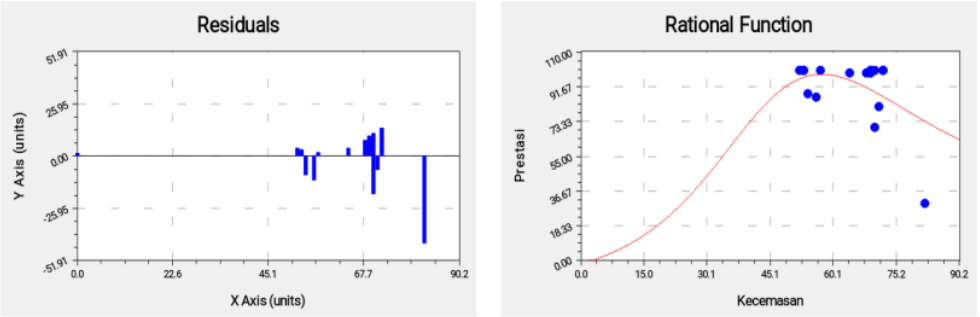

Figure 4. Regression curves and residual curves of rational fit

6
Rational Function:

$$y = \frac{a + bx}{1 + cx + dx^2}$$

Coefficient Data:

a = -1.65908100045E+000

b = 6.88858371201E-001

c = -2.84931198969E-002

d = 3.10063523962E-004

Standard Error S=15.56553982

Correlation coefficient r=0.86039831

3.5. MMF model

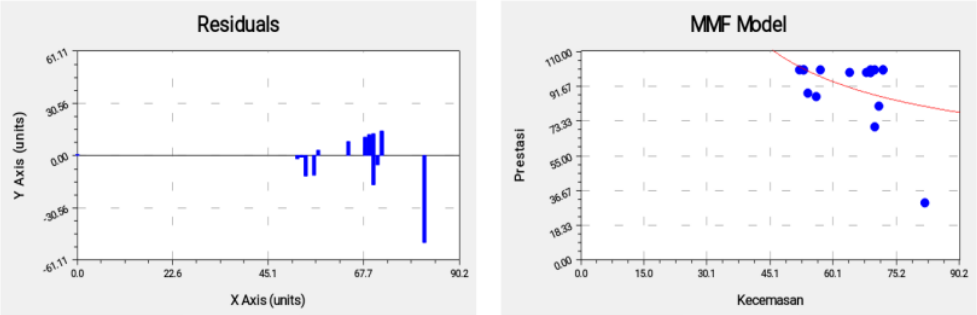

Figure 5. Regression curves and residual curves of MMF fit

MMF Model:

$$y = \frac{ab + cx^d}{b + x^d}$$

Coefficient Data:

a = -6.31390749278E-001

b = -1.65556837152E+000

c = 2.55507299055E+001

d = 2.02261323524E-001

Standard Error S=17.66514538

Correlation coefficient r=0.81577875

3.6. User-defined model

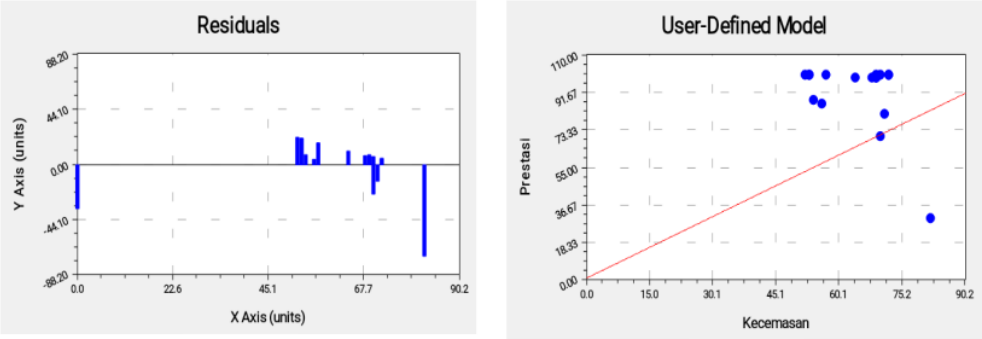

Figure 6. Regression curves and residual curves of user-defined model fit

User-Defined Model:
$y = a + bx$
Coefficient Data:
a = 3.52638471757E+001
b = 8.32198683519E-001
Standard Error S=24.30171527
Correlation coefficient r=0.52583980

3.7. Linier fit

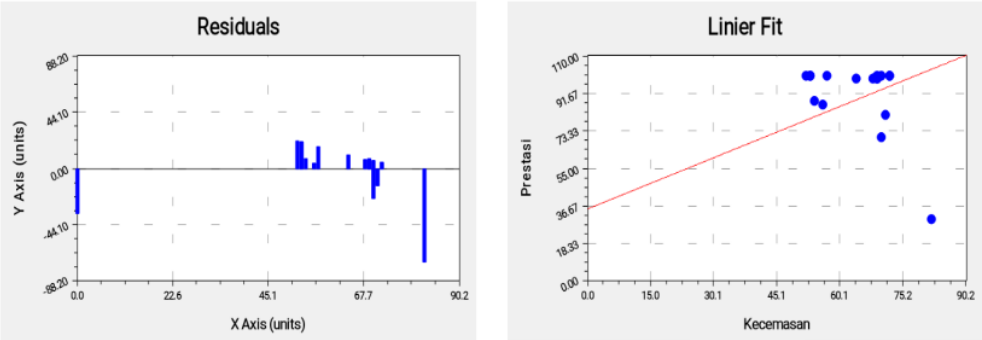

Figure 6. Regression curves and residual curves of linear fit

Linear Fit:
$y = a + bx$
Coefficient Data:
a = 3.52638476044E+001
b = 8.32198676767E-001
Standard Error S=24.30171527
Correlation coefficient r=0.5258398

3.8. Logistik model

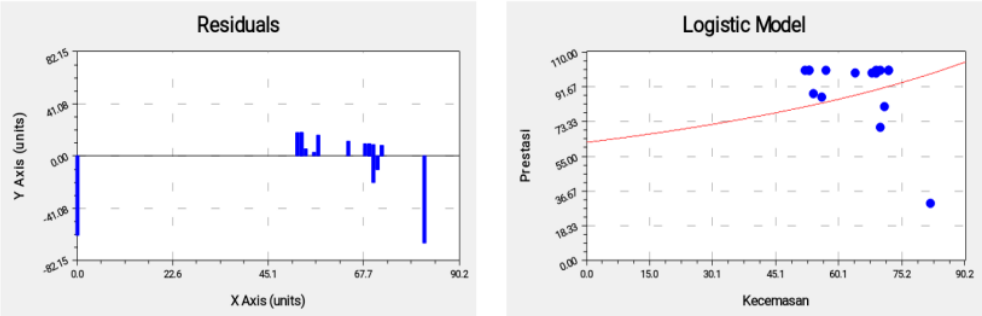

Figure 7. Regression curves and residual curves of logistic model fit

Logistic Model:

$$y = \frac{a}{1 + be^{-cx}}$$

Coefficient Data:

a = 6.19810883828E+000

b = -9.00529567482E-001

c = -4.84809998552E-004

Standard Error S=27.29018799

Correlation coefficient r=0.38032712

Based on the results of the Curve Expert 1.4, it showed that the Linear Fit or linear model can still be used because it always appears even though it is in the 7th position. So it can be said that the linear model is not yet the best model. The best model produced is Polynomial Fit.

4. Conclusion

Linear or Linear Regression Models Fit is not the best model for the relationship between Student Anxiety and Achievement. Based on the results of Curve Expert 1.4, 8 best regression models have been obtained, namely Polynomial Fit, Sinusoidal Fit, Quadratic Fit, Rational Function, MMF Model, User-Defined Model, Linear Fit, and Logistics Model consecutively.

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