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The Role of Growth Mindset on Statistical Learning Outcome with the Regression Approach

Mahdiyah[1], Fildzah Rudyah Putri[2], Mutiara Dahlia[1], Jarudin*[3]

Abstract

This research is to find out how the role of student mindset has on the learning outcomes of Statistics courses, which so far are considered difficult, scary, and less desirable by most students. Someone who has a growth mindset will believe that their talents can always be developed. This research was conducted on 176 students of the Faculty of Engineering, Universitas Negeri Jakarta. By using the correlation test, it is known that there is a 37.3 percent correlation strength between the growth mindset of students and their statistics learning outcomes. The regression equation shows that every increase of one Growth mindset value, will increase 0.39 the value of student Statistics learning outcomes. The results of this analysis are significant at an alpha of 0.05. These results recommend that it is necessary to provide a stimulus that can develop a growth mindset in students to improve critical thinking skills, analysis, and optimism in solving challenges, especially in statistics courses.

Keywords *Growth Mindset, Statistics Learning Outcomes, Regression, Students*

1. Introduction

Humans must experience a learning process throughout their lives. Learning is a process of change from not knowing to know, from not understanding to understanding, and from not being able to be able[1]. Learning is a type of change that is shown in changes in behavior[2]. Changes that are commonly referred to as learning outcomes occur due to experience or training [3]. According to Carr-Chellman[4], learning outcomes are abilities possessed by students after receiving a learning experience. In general, there are three types of learning outcomes, including skills, knowledge and direction, and attitudes and goals. Learning results as changes in behavior in students can be observed and measured by changes in knowledge of attitudes and skills[5]. Change can be interpreted as an increase and development to be better compared to before the student followed the learning process, for example, from not knowing to know, being rude to being polite, and so on[6].

In the Culinary Program Study at State University of Jakarta, as is also common among students in general, Statistics is one of the subjects that is considered difficult, so it is often assumed to be a frightening subject and less attractive to most students. Students had usually felt this assumption since before they took the course. The fact that supports this assumption is also illustrated from the statistics of student learning outcomes obtained by students classified as less good, because many students who obtain achievement of statistical learning results with unsatisfactory or low results.

Many factors support the achievement and success of the learning process, including internal factors, external factors, and learning approach factors. Internal factors are crucial factors besides other factors in achieving targeted learning outcomes. Persistence of a person to achieve learning success is determined by the will, enthusiasm, motivation[7]–[14] and mindset [15], [16] which they have as internal factors.

Mindset is a person's belief on intelligence that he has, or other terms that are commonly used are Implicit Theory of Intelligence [15].Mindset is a view on intelligence possessed by someone in dealing with problems that arise in his life. Siebert[17] also mentions the term proposed by Dweck[18] as a way of thinking. Both terms have the same meaning, namely the way individuals see and interpret the events that occur in their lives. There are two types of theories about intelligence, namely, entity theory and incremental theory. Entity theory says that intelligence

[1] Faculty of Engineering, Universitas Negeri Jakarta, 1322, DKI Jakarta, Indonesia
[2] Faculty of Psychology, Universitas Negeri Jakarta, 1322, DKI Jakarta, Indonesia, Indonesia
[3] Faculty of Information Engineering, Institut Teknologi dan Bisnis Bina Sarana Global, 15113, Indonesia, *Corresponding Author Email: jarudin@global.ac.id

is a thing that is permanent and never changes [15]. Adherents of entity theory can be said to have a fixed mindset. Entity theory is a theory of intelligence which views intelligence as an absolute thing, given from birth, cannot change for life, and determines one's success in all fields[19], [20]. People with a fixed mindset assume that intelligence measured in childhood will not change until they are an adult.

Conversely, people who have growth mindset are said by Dweck [15] as people who embrace the incremental theory of intelligence, which is a theory of intelligence which views intelligence as a thing that can change or dynamic (malleable), and that determines a person's success not the intelligence but the effort that the person spends to achieve his goals[15], [21]. Individuals who have a growth mindset do not consider intelligence as a factor that plays an important role and affects all aspects of life, he believes that with maximum effort every person will successfully achieve his life goals. This makes people with growth mindset have goals that are learning goals or goals for learning [15].

Researchers estimate that the growth mindset is one of the factors that also influence the learning outcomes of Statistics subjects because the assumption of the difficulty of statistics courses is usually felt by students since before, they took the course. Statistics learning outcomes are classified as poor because many students have achieved unsatisfactory statistical learning outcomes or low results. This is in line with previous research which says that students tend to have anxiety about statistics, even the term "statistics phobia" is known as a feeling of phobia towards statistical courses[22].

Based on the theory that has been described before, the researcher assumes that the failure to achieve statistical learning outcomes in the culinary students has a great chance of being caused by the mindset or, more specifically, the growth mindset students have about the Statistical subjects. This assumption is also supported by the results of previous studies which say that mindset is an important factor influencing their feelings that they are included in mathematics, their desire to pursue mathematics majors in the future, and their grades in mathematics [23], [24]. Aiming to improve student learning outcomes Statistics, researchers feel the need to research to analyze and prove whether there is a correlation between student growth mindset with student statistics learning outcomes in the environment of the State University of Jakarta.

2. Materials and Methods

2.1. Research Design

The survey method was used to collecting data between the growth mindset that students have towards learning outcomes they get in statistics courses. Researchers do not provide manipulation or control of the sample, but only take data or information as it is in the field[25]. This research is also descriptive explanatory because it is the research that intends to explain the position of the variables studied and the relationship between one variable with another[26].

2.2. Sampling Technique

This study involved a total of 176 respondents. The Sampling uses a simple random sampling method. Sampling is based on the researcher's consideration of the most helpful and representative respondents in the study[27]. The selection is determined based on knowledge of a population, its members, and the purpose of the study; the sample is taken randomly.

2.3. Data Collection Technique

The instrument used for observation consists of 3 indicators. Each indicator was developed into several question items. The instrument items were developed based on a grid. Consisting of 8 statement items then used as checklist items in the observation instrument. The instrument grid can be seen in table 1.

Table 1. Self-Assessment Instrument Grid.

Indicator	Number Item	Item of number
Intelligence	1,2	2
Level of intelligence	3,4,5	3
self-efficacy	6,7,8	3
Total	8	8

2.4. Data Analysis Technique

Respondents were asked to fill in the paper and pencil questioner provided by the researcher. Student's mindset is analyzed using Theories of Intelligence Scale (TIS) developed by Dweck and Levy [28]. There are 8 questions to measure the growth mindset and a fixed mindset. The scoring method for the TIS measurement tool uses a Likert scale. The scale used is a range of 1 to 6 on each item statement, such as Strongly Disagree (SD), Disagree (D), Somewhat Disagree (SWD), Somewhat Agree (SWA), Agree (A), Strongly Agree (SA). This measuring instrument has been adapted and adjusted to Indonesian culture before it is given to students. The questionnaire was given at the beginning of the semester of statistical studies.

Besides, during the 6-month statistical teaching-learning process in the classroom, student attitudes were observed. Students are also given a final exam at the end of the semester to see the results of their learning for 6 months.

3. Results and Discussion

3.1. Normality Test

A normality test is done to see whether the distribution of data is normal or not [29]. Proof of the Normality test using Lilliefors shows that the Growth Mindset data of students and the statistics are normally distributed at $\alpha>0.05$ (Sig. 0.280 and 0.057).

3.2. Descriptive Analysis Results

Data on mindset that describes how students' mindset in statistics courses is described as in table 2.

Table 2. Demographic Results (N = 176).

	Growth Mindset	Statistic Score
n	176	176
Min	24	63
Max	45	91
Mean	36.25	78.92
Std. Deviation	4.582	6.828

The table 2 that the student mindset data on statistics courses have a range between 24 to 45, with a mean value of 36.25 and a standard deviation of 4,582. The statistical score ranges from 63 to 91, with a mean value of 78.92 and a standard deviation of 6.828.

3.3. Statistical Analysis Results

The correlation between mindset assessment variables on statistics courses with statistics scores obtained by students of the Culinary Program Study, as in the table 3.

Table 3. Correlation Between Growth Mindset and Statistics Score.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,373	0,139	0,130	7,781

The correlation coefficient shows a positive but less strong correlation between mindset assessment of statistics courses and statistics obtained by students, which is 37.3 percent. The role of the coefficient of determination obtained by 13.9 percent, not too big, but it is evident that the figure plays a significant role at alpha 0.05. The results of the analysis of the regression hypothesis between the growth mindset assessment of statistics courses are obtained as table 4.

Table 4. Regression Results.

Model	B	Coefficients	t	Sig.
(Constant)	64.973		11.455	.000
Growth	.385	.258	2.478	.015

The analysis produces a regression equation that illustrates the relationship between the growth mindset and statistical learning outcomes of students at State University of Jakarta.

$$\hat{Y} = 64.97 + 0.39\,X \quad (1)$$

Proof by hypothesis testing using the ANOVA test as in table 5 will show more clearly the results of the significance of the research obtained.

Table 5. ANOVA Result.

Model	df	Mean Square	F	Sig.
Regression	1	270.385	6.142	.015[a]
Residual	86	44.024		
Total	87			

The ANOVA results prove that the change in statistical learning outcomes of culinary students based on changes in the student growth mindset is proven significantly at alpha 0.05. These results can be seen from the values in the analysis table that is sig. 0.015 < alpha 0.05. The proof shows that the student's mindset about difficulties or their perceptions of statistics courses is significantly related to the value of statistical learning outcomes they obtain. The higher the growth mindset is the student's initial perception or belief value about his ability to master statistics, the higher his statistical material mastery is marked by the statistical value obtained by the student.

The results of this study are in line with research conducted by Burnette, et al.[30], which says that women who have the growth mindset will be less susceptible to the negative effects of a stereotype that says mathematics or statistics are difficult sciences. That stereotype will have less effect on individuals with a growth mindset. Although there are many negative stereotypes about mathematics and statistics, individuals with a growth mindset will still be able to get high grades in these courses. Conversely, when someone has a fixed mindset, negative stereotypes will affect them more, so they will tend to get low scores on the final math exam [23] and statistics.

Related to achievement, it is known that a fixed mindset can damage a person's academic performance, while a growth mindset can improve academic performance and be more adaptive to learning [31]. Individuals who have a growth mindset tend to show an increase in academic performance. The achievements and learning outcomes possessed by individuals with a growth mindset will be higher than those who practice a fixed mindset in their lives.

Individuals with a fixed mindset will see intelligence as an absolute thing, given from birth, cannot change for life, and determine someone's success in all fields[32]. People with a fixed mindset assume that intelligence measured in childhood will not change until they are an adult. Furthermore, individuals who have a fixed mindset will assume that intelligence is everything, and intelligence is a factor that plays an important role and influences all aspects of life.

In determining the goals of the things done in their life, people with a fixed mindset also tend to have performance goals or prioritize performance[33]. Groups of people with a fixed mindset make a person less likely to have confidence that their abilities can still be developed if they try to be more creative and hone their abilities. Therefore, individuals with a fixed mindset will tend to feel that their ability to understand statistics will not change.

On the contrary, people who have a growth mindset are said by Wiersema, et al.,[34] as people who embrace the incremental theory of intelligence. The incremental theory of intelligence is a theory of intelligence that views intelligence as a thing that can change or dynamic (malleable), and what determines a person's success is not intelligence but the effort expended by the person to achieve his goals[35]. Individuals who have a growth mindset do not consider intelligence as a factor that plays an important role and affects all aspects of life. He believes that with maximum effort, every person will successfully achieve his life goals. So, people with a growth mindset have goals that are learning goals or goals for learning[36].

For groups of people with a growth mindset, the experience and self-development that they get from that experience become more important than intelligence. People with learning goals do not limit or measure themselves based only on the values they already have. They tend to be brave, more creative, and have more confidence that the ability will worship according to the business or creativity that continues to be developed.

Teenagers with growth and fixed mindset have different perceptions of success and failure [37]. Surely that perception will affect their way of coping from something challenging. Adolescents with a fixed mindset will better assume that success and failure are closely related to one's abilities [38]. Conversely, adolescents who embrace the growth mindset believe success

and failure are not related to one's abilities but are more influenced by effort and practice, the key to academic success [38]. When faced with more difficult and challenging problems, individuals with a growth mindset will use coping strategies that are adaptive and have high expectations for successful problem-solving in the future[39], [40]. So, when dealing with subjects that are considered difficult such as statistics, this individual will be more resilient in facing the challenges given by this course. They will also be more confident and able to implement appropriate coping strategies so that they can get a higher final score.

People with performance goals (people with a fixed mindset) assume that failure on one thing is the same as a failure in all aspects of life. In contrast, people with learning goals (people with a growth mindset) consider failure to improve themselves in the future [41]. Someone with a performance goal will prioritize the results and opinions of people about themselves. When faced with failure, they will feel a total failure that cannot be changed again. Whereas someone with a learning goal will see every process he goes through is learning in his life, even though he faces failure. They consider the failure to occur because they did not try so that such conditions can be corrected in the future by increasing the amount of effort that must be done to achieve something he wants.

The study results should be input for Statistics lecturers who are to give a positive initial understanding to students before the commencement of lecture material. The briefing also begins with an introduction that can help convince students that statistics courses are simple, easy, and fun to learn. Besides, at the beginning of the class, the lecturer will be better if they provide simple and easy-to-understand examples. So the students have a right and positive mindset toward statistics courses. This effort is carried out with the hope that the subsequent planting of the right mindset will have a good impact on the provision of students to obtain higher statistical learning outcomes.

4. Conclusion

The results of the mindset data of culinary students at State University of Jakarta on statistics courses were obtained in the range of 24 to 45 with a mean value of 36.25 and a standard deviation of 4,582. While the value of student learning outcomes in statistics has a range between 63 to 91 with a mean value of 78.92 and a standard deviation of 6.828. Both variables meet the test for normality and linearity.

The correlation coefficient or the strength of the mindset variable relationship with statistics courses with student statistics learning outcomes shows a positive but less strong correlation: 37.3 percent. While the value of the coefficient of determination indicates that there is 13.9 percent of the mindset variables play a role in determining the statistical value results obtained by students. The role of the actual value is not too large, but significant at alpha 0.05.

The regression equation obtained to describe research on the mindset relationship and the statistical learning outcomes of State University of Jakarta students is $\hat{Y}$ ⇄⇄=⇄⇄⇄ 64.97 + 0.39 X or $\hat{Y}$ ⇄⇄=⇄⇄⇄ 64.97 + 0.39 (Mindset). This value shows significantly at alpha 0.05 that each increase in one mindset point about statistics courses increases by 0.39 times the statistical learning outcomes of students at Universitas Negeri Jakarta. The description of the analysis proves that the better or more positive the Growth mindset of students towards statistics courses, the more likely students at the State University of Jakarta will get an increase in Statistics learning outcomes.

The implications of this research can be used as a reference for taking preventive steps in helping to prepare and convince students of their readiness and ability (growth mindset) before they take a statistics course. Lecturers can provide a positive initial understanding to students before the commencement of lecture material. This can help convince students that statistical subjects are simple, easy, and fun to study. Besides, lecturers also need to arrange learning programs using easy-to-understand and straightforward methods for students to improve the achievement of Statistics learning outcomes.

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