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FACTORS INFLUENCING STUDENTS' LEARNING OUTCOMES IN STATISTICAL METHODS COURSE

By Ch. Krisnandari Ekowati
ekowati@staf.undana.co.id
Mathematics Education Department,
Faculty of Teachers Training and Education,
Nusa Cendana University

Abstract: Students' learning outcome in a statistical methods course essentially reflects their learning effort. Indeed it is inseparable from the factors that influence it. This research was conducted to show and analyze the factors that influence students' learning outcomes. The research subjects were 57 students of Mathematics Education Department who took the statistical methods course in 2018/2019 Academic Year. The data was collected through a questionnaire. The analytic tool used in the research is factor analysis. It is acknowledged that there are16 variables that allegedly influence students' learning outcomes, namely: 1) mood; 2) ability to manage time; 3) relationship with family; 4) relationship with friends; 5) lecturer's explanation; 6) residential atmosphere; 7) activities outside the course; 8) IQ; 9) financial conditions; 10) campus learning atmosphere; 11) learning style/ability to understand any teaching materials; 12) level of difficulty of the teaching materials; 13) teaching and learning facilities; 14) interest and motivation; 15) physical and health conditions; and, 16) course references. In this study, however, it was found that the learning outcomes of the students of Mathematics Education Department, Faculty of Teachers Training and Education, Nusa Cendana University, joining the statistical methods course were influenced by four main factors, that is, self-management, physical conditions, inner conditions, and learning styles.

Keywords: *factor analysis, learning outcomes, and statistical methods*

INTRODUCTION

The statistical methods course has enormous benefits for students, especially in determining methods and processing research results for the completion of their theses. Students are, therefore, expected to master it and certainly to have maximum learning outcomes of it. In fact, not all students have good learning outcomes in the statistical methods course. Most students consider statistical methods course difficult to understand. This is why instead of studying harder to understand its teaching materials, the students usually give up and are unmotivated to learn the course harder. They often complain about their lack of understanding of this subject because of a large number of its teaching materials to be studied; some students even assume that their lecturer does not explain it well. The phenomenon that occurs is a decrease in students' learning outcomes that can be seen through their final grades for the course, that is, the percentage of students who do not pass this course increases; some students even have to take this course several times.

The students' learning outcome essentially is a reflection of their learning effort. In general, the stronger their learning effort, the better their learning outcome. Obviously, this is inseparable from the factors that influence it, such as their interests, motivation, learning styles, lecturer's teaching styles, teaching and learning facilities.

Adjani and Adam (2013: 8) discover that experience and motivation have a positive influence on learning outcomes. If students are interested in a particular course, they usually tend to listen and understand the course materials provided and have a positive impact on their learning outcomes. Students who have strong and high motivation will increase their efforts and activities to achieve high learning outcomes. Iskandarsyah and Imam Ghozali (2012: 10) conclude that some factors that could affect learning outcomes are students' learning styles, lecturer's teaching styles, lecture structures, and teaching and learning facilities. Muryono (2000) also reveal that there are two things that affect students' learning outcomes, namely: 1) internal factors such as physiological and psychological factors; and, 2) external factors like family environments (that is, family economic status, education, parents' attention), and school environments (including facilities and infrastructures, competence of instructors, curriculum, and quality of lectures) as well as social environtments related to social culture and participation in learning. In other words, it can be concluded that there are many factors that influence students' learning outcomes.

Based on the argument, it is, therefore, important to study those factors that influence students' learning outcomes in the statistical methods course. Its aim is to find a better solution in improving students' quality and learning outcomes.

LEARNING OUTCOMES

Learning outcomes are abilities in the form of new skills and behaviours as a result of trainings and experiences. In this case, learning outcome is an ability

possessed after students receive their learning experience during lectures.

In the process of education, learning outcomes can be interpreted as a result of teaching and learning processes, that is, mastery (IQ), emotional changes or changes in behavior that can be measured by certain tests. According to Nana Sudjanain Kunandar (2008: 276), learning outcomes are results of a learning process by using certain measurement tools in the form of tests arranged in a planned manner, both written and performance tests.

Learning outcomes are the maximum results achieved by a person after carrying out learning activities that are given based on certain measurements (Ilyas, 2008). Meanwhile, Shah Syah M (2006) argue, learning outcomes are changes in behavior that are considered important and expected to reflect the changes that occur as a result of students' learning, both those with a dimensional dimension and a state dimension.

In other words, learning outcomes are the results obtained after attending a learning program stated with a score or a value. The measurement of a student's achevement in formal education has been determined quarterly and is often referred to as a mid-term test and a final test, but in terms of learning outcomes it is expected to have improvements made in the materials being taught.

Factors Influencing Learning Outcomes

In general, factors that can influence one's learning outcomes, according to Slameto (2003), can be gouped into several factors. The first is internal factor. Internal factors are related to the whole person including his/her physical or mental or psychological conditions. These internal factors are often called intrinsic factors which include physiological and psychological conditions including a person's interests, intelligence, talent, motivation, learning styles and others.

The second is external factor. External factors come from outside an individual person. This factor is often called an extrinsic factor which includes everything that comes from outside an individual who can affect his/her learning achievement both in the social environment and other environments (Djamara, 2008). Extrinsic factors include several things, namely, school environment, commuunity environment, and time. A school environment as a formal education institution plays an important role in a student's learning outcomes. In this case, the school environment factors include facilities or infrastructures prepared by a campus, lecturers' teaching styles, lecture rules and others.

Factor Analysis

Factor analysis in principle tries to find an interrelationship between a number of variables that are independent of one another so that one or several sets of variables can be made fewer than the original ones (Santoso, 2003: 93). This factor analysis assesses which variables are considered appropriate to be included in further analysis. This test is completed by inserting all the existing variables; those variables are then tested in several tests.

The main purpose of factor analysis is to define the structure of a data matrix and analyze the structure of interrelationship (correlations) among a large number of variables (test score, test items, questionnaires answers) by defining a set of similarities within those variables or dimensions called factors. With factor analysis, the researcher identifies each dimension of a structure and then determines how far each variable can be expalined by each dimension. After knowing the dimensions and explaining each variable, then the two main objectives of factor analysis can be completed, that is, data summarization and data reduction. In short, factor analysis needs to find a way to summarize information that exists in an original variable into a set of new dimensions or factors (Ghozali, 2006: 267).

The main principle in factor analysis is a correlation whose assumptions that must be fulfilled, Santoso (2003: 95) says, are as follows:

a. correlation between independent variables must be strong enough, for example, above 0.5.
b. large partial correlation, the correlation between two variables by assuming other remaining variables, must be small (anti-image correlation).
c. testing the entire correlation matrix (correlation between variables) using the *Bartlett Test of Sphericity or Measure Sampling Adequacy* (MSA) requires a significant correlation between at least several variables.
d. in some cases, the assumption of normality of the variables or factors that occur should be fulfilled.

Its logic of testing is if a variable does have a tendency to group and form a factor, then the variable will have a high correlation with other variables. On the other hand, variables with weak correlations with other variables tend not to group in certain factors.

The basic process of factor analysis includes the following steps (Santoso, 2003: 96):

a. determine what variables will be analyzed.
b. test the variables that have been determined, using the *Bartlett Test of Sphericity* and MSA measurements.
c. conduct a core process in factor analysis, factoring or deriving one or more factors from the variables that have passed the previous variable test.
d. do the process of factor rotation or rotation of the factors that have been formed whose purpose is to clarify the variables that fall into certain factors.
e. avlidate the factor results to find out whether the factors formed are valid.

RESEARCH METHOD

This research is a survey research aimed at finding out the factors that influence students' learning outcomes. Survey research is a quantitative study using the same structured questions for everyone, then all answers obtained by researchers are recorded, processed and analyzed (Sugiyono, 2011) 5).

In this study, the populations were 57 students of the Mathematics Education Department, School of Teachers Training and Education, Nusa Cendana University, in 2018/2019 Academic Year, who took the statistical methods course. In this study, the sampling technique used was saturated or population samples. This sampling technique was chosen because the population is less than 100.

The instruments used to collect data in this study are as follows: 1) a questionnaire containing a list of questions about the factors that influence the achievement of students' learning outcomes; 2) interviews; and, 3) documentation.

The collected data were analysed inferentially or inductively using exploratory factor analysis whose calculation process is made using SPSS software version 22. This factor analysis is carried out in two stages. The first step is to assess the variables that are suitable for factor analysis. This analysis uses the *KMO* and *Bartlett's test* values to determine whether a variable can be further analyzed. Furthermore, the MSA value of each variable is seen on the *Anti-image Matrices* where the variables with the smallest MSA value must be removed before further analysis. This process is repeated until a variable with an MSA of less than a significance level of 0.5 is not found. This analysis aims to reduce the variables that determine students' learning outcomes to one or more factors in order that later it would be easier to be identified in decision making process.

RESULTS AND DISCUSSION

At the end of the first stage factor analysis, it was found that there were five out of 16 variables which had to be eliminated and could not be used in factor analysis (See Table 1). So, there were 11 remaining variables for further testing.

Table 1: Variable with MSA < 0.5

No.	Variable	MSE
1.	Activities outside the campus	0.433[a]
2.	IQ	0.442[a]
3.	Learning atmosphere in home	0.431[a]
4.	Level of difficulty of the material	0.440[a]
5.	Learning and teaching faclities	0.487[a]

For the remaining 11 variables, a further stage of factor analysis is repeated using the *KMO* and *Bartlett's test* values to determine whether they can be further analyzed. Its results can be seenfollowing Table 2.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.681
Bartlett's Test of Sphericity	Approx. Chi-Square	108.672
	df	55
	Sig.	.000

In the *KMO* and *Bartlett's Test* table above, the KMO *Measure of Sampling Adequacy* (MSA) figure is 0.681, while its value is 0.681 ('> 0.5). This shows the adequacy of the sample. The *KMO* and *Bartlett's Test* (without the *chi-square* value) is 108.672 with a significance value of 0.000. This shows that there is a correlation between variables and it is feasible for further processing. Moreover, to find out which variables can be processed further and which can be issued can be seen in the *Anti-image Matrices* table below.

Anti-image Matrices

		Mood	Ability to manage time	Relationship with family	Relationship with friends	Lecturer explanation	Atmosphere of residence	Financial condition
Anti-image Covariance	Mood	,758	,092	,020	,201	-,104	-,027	,052
	Ability to manage time	,092	,717	,028	-,173	,093	,097	,058
	Relationship with family	,020	,020	,657	,076	-,043	-,002	-,075
	Relationship with friends	,201	-,173	,076	,680	-,051	-,081	-,035
	Lecturer explanation	-,104	,093	-,043	-,051	,641	,140	,152
	Atmosphere of residence	-,027	,097	-,002	-,081	,140	,848	,040
	Financial condition	,052	,058	-,075	-,035	,152	,040	,836
	Ability to understanding material	-,068	,041	-,187	,066	-,151	-,103	,111
	Interest and motivation	-,005	-,112	,186	-,064	,117	-,155	-,149
	Physical and health condition	,012	-,106	-,138	-,108	,150	,047	,074
	Lack of references	,113	-,023	,188	,050	-,039	,096	-,029
Anti-image Correlation	Mood	,752[a]	,125	,028	,279	-,149	-,033	,065
	Ability to manage time	,125	,768[a]	,041	-,246	,137	,12	,075
	Relationship with family	,028	,041	,613[a]	,113	-,067	-,003	-,101
	Relationship with friends	,279	-,246	,113	,739[a]	-,077	-,107	-,046
	Lecturer explanation	-,149	,137	-,067	-,077	,727[a]	,190	,207
	Atmosphere of residence	-,033	,124	-,003	-,107	,190	,547[a]	,047
	Financial condition	,065	,075	-,101	-,046	,207	,047	,661[a]
	Ability to understanding material	-,089	,056	-,265	,091	-,216	-,128	,139
	Interest and motivation	-,007	-,159	,274	-,092	,176	-,202	-,196

		Ability to understand material	Interest and motivation	Physical and health condition	Lack of references
Anti-image Covariance	Mood	-,608	-,005	,012	,113
	Ability to manage time	,041	-,112	-,106	-,023
	Relationship with family	-,187	,186	-,138	,188
	Relationship with friends	,066	-,064	-,108	,050
	Lecturer explanation	-,151	,117	,150	-,039
	Atmosphere of residence	-,103	-,155	,047	,096
	Financial condition	,111	-,149	,074	-,029
	Ability to understanding material	,762	-,087	-,107	-,050
	Interest and motivation	-,087	,696	,051	,078
	Physical and health condition	-,017	,051	,617	,235
	Lack of references	-,050	0,78	,235	,656
Anti-image Correlation	Mood	-,089	-,007	,018	,161
	Ability to manage time	,056	-,159	-,160	-,033
	Relationship with family	-,265	,274	-,217	,296
	Relationship with friends	,091	-,092	-,165	,074
	Lecturer explanation	-,216	,176	,238	-,060
	Atmosphere of residence	-,128	-,202	,065	,129
	Financial condition	,139	-,196	,104	-,039
	Ability to understanding material	,682[a]	-,119	-,024	-,071
	Interest and motivation	-,119	,675[a]	,078	,115

Anti-image Matrices

	Mood	Ability to manage time	Relationship with family	Relationship with friends	Lecturer explanation	Atmosphere of residence	Financial condition
Physical and health condition	,018	-,160	-,217	-,165	,238	,065	,104
Lack of references	,161	-,033	,286	,074	-,060	,129	-,039

Anti-image Matrices

	Ability to undestand material	Interest and motivation	Physical and health conditipn	Lack of references
Physical and health condition	-,024	,078	,637[a]	,370
Lack of references	-,071	,115	,370	,610[a]

a. Measurements of Sampling Adequacy (MSA)

In the *Anti-image Matrices* table above, specifically in the (*Anti-image Correlation*) section, a number marked (a) indicates the amount of MSA of a variable. Since MSA value of each variable is > 0.5, then all variables can be processed further.

The second stage of the factor analysis process is to find out whether the feasible variable can be reduced to one or more factors. In SPSS, this is prepared by refering to the *Communalities* Table 3 below. Hence, *Communalities* are basically the amount of variance of an original variable that can be explained by the existing

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factors. The greater the *communalities*, the more closely it is related to the formed factors.

Table 3: Communalities

	Initial	Extraction
Mood	1,000	,474
Ability to manage time	1,000	,592
Relationship with family	1,000	,653
Relationship with friends	1,000	,598
Lecturer explanation	1,000	,611
Atmosphere of residence	1,000	,691
Financial condition	1,000	,696
Ability to understanding material	1,000	,549
Interest and motivation	1,000	,640
Physical and health condition	1,000	,717
Lack of references	1,000	,676

Extraction Method: Principal Component Analysis.

In *communalities* table, the mood variable is 0.474. This means that about 47.4% of the variance of mood variables can be explained by the factors formed. The ability to manage time variable is 0.592 which means that 59.2% variant of ability to manage time variable can be explained by the factors formed. So can other variables. This means that the smaller the value of *communalities*, the weaker the relationship with the factors formed.

The *eigen values* show the relative importance of each factor in calculating the variance to the 11 variables analyzed.

Total Variance Explained

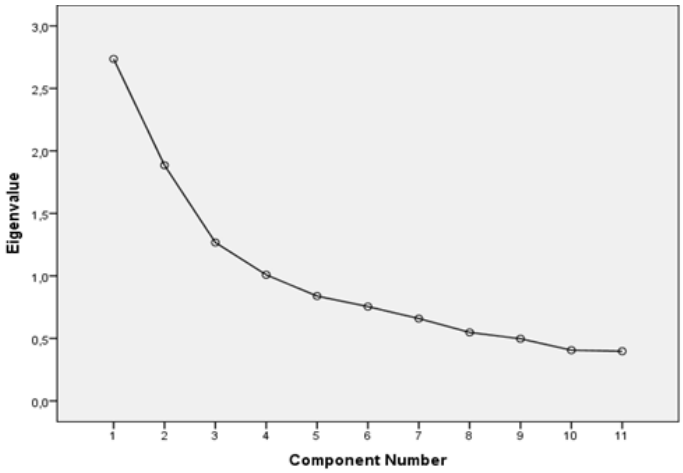
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,736	24,872	24,872	2,736	24,872	24,872
2	1,885	17,140	42,012	1,885	17,140	42,012
3	1,268	11,523	53,536	1,268	11,523	53,536
4	1,009	9,173	62,708	1,009	9,173	62,708
5	,839	7,629	70,337			
6	,755	6,860	77,197			
7	,659	5,992	83,189			
8	,548	4,984	88,173			
9	,497	4,520	92,692			
10	,406	3,691	96,384			
11	,398	3,616	100,000			

Extraction Method: Principal Component Analysis.

The *Total Variance Explained* table above shows there are four factors formed out of the 11 variables entered. The *eigen value* of each factor is > 1. Factor 1 *eigen value* is 2.736 with the variance of 24.887%; Factor 2 1.885 with the variance of 17.140%); Factor 3 1.268 with the variance of 11.523%; and, Factor 4 1.009 with the variance of 9.173%.

Eigen value describes the relative importance of each factor in calculating the variance of the 11 variables analyzed. If all variables are added together, the value is 11 (which is equal to the number of variables). The total variances of the 11 variables when extracted into four factors are: 24.872% + 17.140% + 11.523% + 9.173% = 62.708%. The amount of variance that can be explained by the new factors formed is 62.708%, while the remaining 37.292% is explained by other factors that ate not examined.

Based on the *eigen value*, the number of factors formed can be determined. This can also be seen visually in the *Scree plot* which explains the basis of the number of factors (*component number*). and shows The graph below shows this.



Picture 1. Scree Plot Graph

It can be seen that from 1 to four factors, the direction of the line decreases quite sharply, but it still has an *eigen value* above 1, whereas the rest of the factors formed show an *eigen value* less than 1. This shows that those four factors are the best factors to summarize the 11 variables that were tested.

After knowing that those four factors are the most optimal number, the *Component Matrix* Table 4 below shows the distribution of the 11 variables on the four factors formed. The numbers listed in the *Component Matrix* Table show the correlation between a variable with each factor formed. The process of determining which variables will go into which factors is complete by making a large comparison of correlations on each row.

Table 4: Component Matrix[a]

	Component			
	1	2	3	4
Mood	-,573	,149	,341	-,084
Ability to manage time	,634	,070	-,314	,295
Realationship with family	-,323	,703	-,095	-,214
Relationship with friends	,662	,077	-,204	,335
Lecturer explanation	-,703	-,123	-,172	,267
Atmosphere of residence	,240	,191	,727	,263
Financial condition	,416	-,194	,230	-,658
Ability to understanding material	-,509	,275	,265	,380
Interest and motivation	,577	-,149	,509	,164
Physical and health condition	,339	,745	-,215	-,026
Lack of references in course	-,176	-,785	-,128	,113

Extraction Method: Principal Component Analysis.
a. Four Components Extracted.

Table 4 is the *Rotated Component matrix* value of the loading factor of each variable. Factor loading is the magnitude of the correlation between the factors formed by these variables. For the mood variables, the correlation between mood variables with factor one is -0.573, factor two 0.149, factor three 0.341, and factor four -0.084. This can be said that the mood variable is included into factor three because its correlation was the highest. This is also the case for the loading factor of other variables. The ability to manage time variable is included in factor one, relationship with family factor two, relationship with friends factor one, lecturer explanation factor four, atmosphere of residence factor three, financial condition factor one, the ability to understand teaching materials factor four, interest and motivation factor one, physical condition and health factor two, and the lack of references factor four.

The final results of the factor analysis of the 11 variables analyzed were finally reduced to four factors as described below. Factor 1 consists of ability to manage time, relationships with friends, financial conditions, interests and motivation. This factor can be called **self-management**. Correlation of such variables as the ability to manage time, relationships with friends, financial conditions, interests and motivation is positive. This means that the better the quality of a student's self-management, the better his/her learning outcomes in the statistical methods course.

Factor two consists of variables related to family, physical condition, and health. These factors can be called **physical conditions**. Correlation of such variables as relationship with family, physical condition, and health is positive meaning that the better the quality of a student's physical condition, the better its influence on his/her achievement in statistical methods courses.

Factor three consists of mood variable and the atmosphere of residence variable. These factors can be called **inner conditions**. The correlation of mood variables and the atmosphere of residence is positive. This means that the better the quality of a student's inner condition, the better his/her achievement or learning outcomes in the statistical methods course.

Factor four consists of three major variables, namely, lecturer explanation, the ability to understand teaching materials, and lack of references variables. These are called **learning styles**. The correlation of lecturer explanation variable and the ability to understand teaching materials is positive, except for the lack of lecture references which is negative. This means that a better quality of those two factors would positively affect (improve) students' achievement or learning outcomes in the statistical methods course.

Based on these four factors, it can be stated that learning outcomes of students of the Mathematics Education Department joining statistical methods course are influenced by several factors including: self management consisting of their ability to manage time, relationships with friends, financial conditions, interests and motivation; physical factor consisting of relationships with family, physical and health conditions; inner condition consisting of mood, residential atmosphere variables; and, learning style consisting of lecturer's explanation, the ability to understand teaching materials, and lack of references.

CONCLUSIONS AND SUGGESTIONS

It is known that students' learning outcome in the Mathematics Education Department, School of Teachers Training and Education, Nusa Cendana University, joining the statistical methods course is influenced by four main factors, that is, self-management, physical condition, inner condition, and learning style factor.

Based on the results of the study, it is expected that the results of this study can be useful for lecturers who teach courses like statistical methods and policy makers at the school of teachers training in general, the department of mathematics education in particular in developing and improving any factors that affect their students' learning outcomes. These may also be related to campus policies that should be made better in order to have a positive contribution for students' learning outcomes. In addition, there is a need for a follow-up research, among others, to see the extent of the influence of these factors in contributing to the acquisition of better GPAs for all students.

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