

Structural Equation Modelling (SEM) Method In The Analysis of Affecting Factors Student Achievement With The System Learning Online

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Article Info	ABSTRACT
<p>Article History Received : 29 November 2022 Accepted : 10 Desember 2022 Published : 28 Februari 2023</p> <hr/> <p>Keywords: Online study system, Achievement, campus.</p>	<p>Online college learning systems must be performed effectively in order for students to achieve. There are some factors that influence a student's feat of learning whether it is a factor within a student or factor outside of a student. The study was done with a view to discovering any construction that affected the performance of student learning. The method used was the Structural equation Modelling (SEM). Research materials are the results of the 2017, 2018 and 2019 advanced student studies of students from the university of Sumatra, using a simple random sampling technique. Data analysis obtained parameters: coefficient lecturer.044, coefficient 063 student and coefficient campus 0.190.This coefficient also includes a low coefficient of stability and if out of these 3 collations increases the coefficient of achievement with the SKFK which is able to approach to be a low coefficient where the coefficient is low if the coefficient is at intervals of 0.200–0.399.</p>

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INTRODUCTION

A college is a formal educational institution that plays an important role in conducting a culture of research, education and community service or better known as Tri Dharma Tinggi Tinggi. At college he was also known as the Performance Index. Where is this Performance Index that can prove that the achievements achieved by students are high (Almida and Simos, 2019). According to Mustofa et al (2019) that bold learning is a remote education system with a set of teaching methods where there are teaching activities that are carried out separately from learning activities. Bold learning is enforced through internet and web 2.0 (Alessandro, 2018).

Courageous learning has been carried out in college contexts, proven from several studies that have been carried out in higher development. A college is a formal educational institution or institution that plays an important role in conducting research, education and community service activities or better known as Tri Dharma Universitas. According to Webster's Now World Dictionary (1962), education is a process of development and training that includes aspects of knowledge, skill, and personality, primarily carried out in a form of formula. It is a private school or learning organization (in Nanang Fatah, 2004: 14).

The educational function is to prepare quality young people, prepare manpower and prepare good citizens (DwiSiswoyo, et al. 2007: 83). The purpose of national education under Law No. 20 of 2003 article 3 is, "To develop the potential of students to become human beings who believe and fear God, are noble, healthy, knowledgeable, creative, independent and responsible citizens". Based on the above understanding,

function and purpose of education, education can be interpreted as the process of preparing a human to develop and train as a qualified human being with knowledge, skills and personality to become a human being who believes and fears the One God, noble, healthy, knowledgeable, be skilled, capable, creative, independent, and responsible for being a good workforce and citizen. The educational process required human resources capable of transferring and guiding the nation's successors.

In colleges there is also known as the Achievement Index. The word "performance" comes from the Dutch word *prestatie*. Later in Indonesian it became "performance" which means "property". The word achievement is widely used in various fields and activities, including arts, sports, and education, especially learning. Achievement is a specialized level of success due to learning tasks, or a certain level of expertise in school or academic tasks (Chaplin, 2008). According to (Djamarah, 2011), the understanding of achievement is the result of an activity that has been carried out, created, both individually and in groups. Bloom's academic is a learning process that results in changes in knowledge, application, understanding, analysis power, synthesis and evaluation. (Sobur, 2006) academic achievement is a change in behavioral competence, or ability that can increase and result from learning situations.

Where is this Achievement Index that can prove that the achievements achieved by students are high (Almida and Simos, 2019). According to (Mustofa et al, 2019) that online learning is a remote education system with a set of teaching methods where there are teaching activities that are carried out separately from learning activities. Online learning is enforced through internet and web 2.0 (Alessandro, 2018). Online learning has been widely conducted in a college context, proven from several studies that have been widely conducted in a college context.

Teachers are an essential component of learning teaching, the success of the teaching process depends on the teacher's skill in using the methods, techniques and tactics of the lesson (Riyani, 2012). The success of a biographical learning process is determined by the quality and ability of professors, the quality of education is closely linked with the learning process is one of the most important aspects of education (Qurbani, 2020). Long-distance learning is the kind of learning that the media is using tech as a tool for doing this (Khoirunisa, 2020). According to (Mather, 2018 :5) this long-distance learning is the main component of Internet travel where there is no Internet for online learning it can't be done properly.

The Structural Equation Modelling (SEM) is a statistic modeling technique that runs in cross-sectional, linear, and complex, SEM is a combination of two multivariate techniques that are analytic factor and path-analysis (Latumenten, 2018). SEM is a multivariate method of analysis currently used to describe linear connections simultaneously between directly and indirectly measured (Ginting, 2009).

Structural Equation Modelling (SEM) is a cross-sectional, linear, and complex statistical modeling technique, which combines two multivariate techniques: confirmatory factor analysis and path analysis (Latumenten, 2018). Structural Equation Modeling (SEM) is a multivariate method of analysis that can be used to describe the simultaneous linear relationship between observational variables (indicators) and indirectly measurable variables (Latent variables) (Prihandini & Sunaryo: 2011).

Confirmatory analysis is a method of multivariate analysis used to confirm whether a constructed model corresponds to that used to confirm whether the constructed model corresponds to that hypothesized. Ghazali (2005) suggests that Confirmatory Factor Analysis is one of the multivariate analysis methods used to test or confirm hypothesized models. The hypothesized model consists of one or more latent variables, which are measured by one or more indicator variables.

There are some variables in the shem, among them. Latent variables, according to (Singgih2011:7) are variables that cannot be directly measured except by at least one variable manifest. Variable manifest according (Singgih,2011:7) is the variable used to explain or measure a latent variable. Independent variables are what are viewed as the dependent variable that is thought to be the result (Krlingr,2004:58). According to (Abdilah, HM, 2015:18), there are two types of independent variables that are active independent variants and independent attributes variables. Comparative matori analysis is a method of multivarial analysis used to categorize whether the model is built according to the one used to categorize whether the model is built as outlined.

Whereas track analysis is the development of a form of regression with the purpose of providing assessments of importance and significant connections because of the hypotheses in a variable and regression system that involve more than one free variable. Regression may also be called multiple regression. The word multiple is plural or more than one variable.

Path analysis is the development of the form of multiple regression with the aim of providing estimation of the degree of interest and significance of the causal relationship in a set of variables and multiple regression is a model of rigour or prediction involving more than one free variable. Multiple regression can also be called multiple regression. Multiplr words are a plurality or more of one variable.

There are several programs offered for SEM, such as LISREL, AMOS, ROMANO, EQS, LISCOMP, SABATH. LISREL is a program that can be used extensively in research compared to other LISREL programs that is the only SEM program that can estimate SEM problems that are almost impossible for other SEM programs (Latan, 2013:6). Thereafter, the AMOS program is a program often used in research after LISREL. AMOS is one of the programs or software used to systematize models of SEM structural equations (Ghozali, 2004). AMOS implets a common approach to data analysis of structural equation models describing the analysis of covariance structures. This approach includes the special case of many well-known conventional techniques, including common linear models and general factor analysis

RESEARCH METHOD

Methodology *Structural Equation Modelling* (SEM) in the factor analysis that affects the performance of students with online learning systems. The method in this study is to use cases conducted through a thorough process of investigation or examination, detailed and detailed to a specific or specific event, to get information on a carefully researched problem. The study used primary data derived from the questionnaire's distribution in 250 respondents who were taken from 2017, 2018, 2019 north sumatran university students. For a Semite model with the number of latent variables to four and each latent variable explained by three or more variable manifest, the number of 200-300 data samples is considered sufficient.

RESULTS AND DISCUSSION

1. Respondent data description

A survey was made of 278 north Sumatra university student respondents in September 2021. And the questionnaires that filled the criteria count for 250 respondents. Where the characteristics of respondents have four criteria based on gender, based on entry years, by program studies and by faculty.

2. Data processing

To find factors that affect the performance of north Sumatra university student studies can be determined on a semm based on each of the following steps:

2.1. Theoretical model development

Based on the study of the proposed model for links between variables like the bottom:

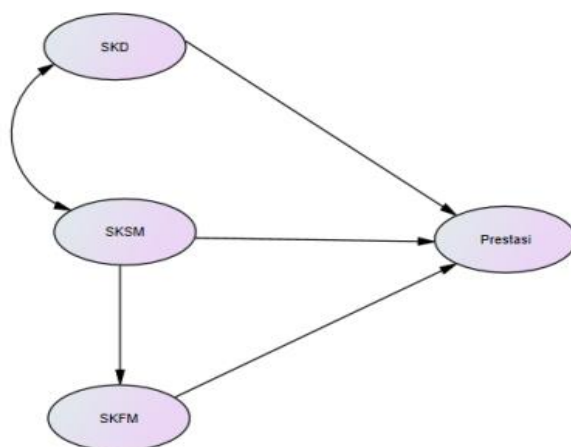


Figure 1. A theoretical framework model

Indicators - any indicator of this construction can be seen at the following chart:

Table 1. Constructs and indicators

Constructs	Construct Indicator	Simbol
Attitude to Lecturers (ATL)	1. Teacher on schedule	X ₁₁
	2. Material preparedness	X ₁₂
	3. Reference book conferencing	X ₁₃
	4. assign an assignment	X ₁₄
	5. Intrusion	X ₁₅
Attitude to Fellow Students (ATFS)	1. Cofferece video	X ₂₁
	2. Get in on time	X ₂₂
	3. seriousness	X ₂₃
	4. Study friends	X ₂₄
	5. The community atmosphere	X ₂₅
	6. Understanding parents	X ₂₆
Attitude to campus facilities (ATCF)	1. Internet help	X ₃₁
	2. Laboratory	X ₃₂

	3. Library	X_{33}
	4. Mass Media	X_{34}
	5. Exchange students	X_{35}
	6. apprentice	X_{36}
achievements	1. Get a high IP	Y_1
	2. Finish college on time	Y_2
	3. Continu S2	Y_3

2.2. Preparing shem's diagram

Compiling causality from the existing study is a diagram of the causality line between construction and its indicator:

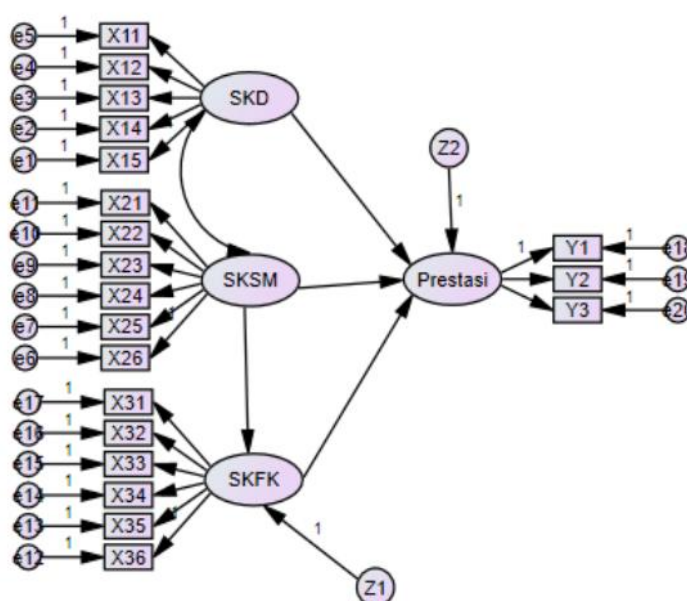


Figure 2. A model diagram of the causality relationship line

2.3. Conversion diagram to spatial equations

The structural equations of the chart are stated in the form as brparticipation:

$$\text{Achievement} = \beta_1 ATL + \beta_2 ATFS + \beta_3 ATCF + Z_2$$

3. Imperfect model evaluation

Before a statistical test of the influence of each independent variable on the dependent variable in the fit model, it will first be done to evaluate the stuctural model produced by the fit model:

3.1. Parameters value estimate

Testing of the hypothesis presented by *standardized regressiocoeffenation*:

Table 2. Regression weight

			Estimate	S.E.	C.R.	P	Label
ATCF	<- --	ATFS	1.617	.291	5.565	***	par_18
achievements	<- --	ATL	-.038	.410	-.093	.926	par_19
achievements	<- --	ATFS	.069	.532	.129	.897	par_20
achievements	<- --	ATCF	.127	.204	.621	.535	par_21
X11	<- --	ATL	1.000				
X12	<- --	ATL	1.139	.132	8.621	***	par_1
X13	<- --	ATL	1.054	.115	9.188	***	par_2
X14	<- --	ATL	.917	.140	6.561	***	par_3
X15	<- --	ATL	.647	.117	5.525	***	par_4
X21	<- --	ATFS	1.000				
X22	<- --	ATFS	1.024	.208	4.919	***	par_5
X23	<- --	ATFS	.947	.186	5.098	***	par_6
X24	<- --	ATFS	1.505	.276	5.458	***	par_7
X25	<- --	ATFS	1.013	.201	5.048	***	par_8
X26	<- --	ATFS	1.402	.254	5.511	***	par_9
X31	<- --	ATCF	1.000				
X32	<- --	ATCF	.513	.102	5.024	***	par_10
X33	<- --	ATCF	.580	.103	5.613	***	par_11
X34	<- --	ATCF	.853	.101	8.481	***	par_12

			Estimate	S.E.	C.R.	P	Label
X35	<- --	ATCF	.844	.088	9.552	***	par_13
X36	<- --	ATCF	.835	.089	9.387	***	par_14
Y1	<- --	Achievements	1.000				
Y2	<- --	Achievements	1.757	.449	3.909	***	par_15
Y3	<- --	Achievements	1.076	.227	4.737	***	par_16

Tabel3. Standardized regression weights

			Estimate
ATCF	<---	ATFS	.992
Achievements	<---	ATL	-.044
Achievements	<---	ATFS	.063
Achievements	<---	ATCF	.190
X11	<---	ATL	.649
X12	<---	ATL	.655
X13	<---	ATL	.702
X14	<---	ATL	.492
X15	<---	ATL	.392
X21	<---	ATFS	.396
X22	<---	ATFS	.546
X23	<---	ATFS	.450
X24	<---	ATFS	.615
X25	<---	ATFS	.435
X26	<---	ATFS	.626
X31	<---	ATCF	.728
X32	<---	ATCF	.378
X33	<---	ATCF	.396
X34	<---	ATCF	.593
X35	<---	ATCF	.665
X36	<---	ATCF	.653
Y1	<---	Achievements	.455
Y2	<---	Achievements	.788
Y3	<---	Achievements	.508

Tabel 4. Variance

	Estimate	S.E.	C.R.	P	Label
ATL	.405	.076	5.312	***	par_54
ATFS	.256	.085	3.024	.002	par_55
Z1	.010	.045	.232	.817	par_56
Z2	.289	.108	2.691	.007	par_57
e1	.557	.058	9.609	***	par_58
e2	.700	.075	9.384	***	par_59
e3	.463	.052	8.928	***	par_60
e4	1.066	.102	10.436	***	par_61
e5	.929	.086	10.829	***	par_62
e6	1.383	.126	10.961	***	par_63
e7	.633	.067	9.425	***	par_64
e8	.903	.087	10.382	***	par_65
e9	.952	.095	10.054	***	par_66
e10	1.128	.105	10.729	***	par_67
e11	.783	.079	9.935	***	par_68
e12	.605	.070	8.589	***	par_69
e13	1.075	.100	10.757	***	par_70
e14	1.232	.114	10.833	***	par_71
e15	.915	.091	10.092	***	par_72
e16	.611	.067	9.145	***	par_73
e17	.639	.069	9.305	***	par_74
e18	1.135	.126	9.003	***	par_75
e19	.570	.207	2.757	.006	par_76
e20	1.010	.116	8.719	***	par_77

3.2. Measurement model fit

Uji reliability

Reability is a measure of the internal consistency of the indicator of a variable. There are two ways in which composite (control) reactivity and variance extraction are used. The cut-off value constructability is at least 0.07 while the cut-off value for the extracted variance is at least 0.50.

Composite reability can be by the formula:

$$construct\ reability = \frac{(\sum\ standardizd\ loading)^2}{(\sum\ standardizd\ loading)^2 + \sum\ \epsilon_j}$$

1. *standardized loading* to every indicator.
2. ε_j is *measurement error* = 1 - (*standardized loading*)

SUM *standardized the loading* for :

$$\text{achievements} = 0.0455 + 0.788 + 0.508 = 1.751$$

$$\text{ATCF} = 0.728 + 0.378 + 0.396 + 0.593 + 0.465 + 0.653 = 3.213$$

$$\text{ATFS} = 0.396 + 0.546 + 0.45 + 0.625 + 0.435 + 0.626 = 3.068$$

$$\text{ATL} = 0.649 + 0.655 + 0.702 + 0.492 + 0.392 = 2.89$$

SUM *measurement error* for :

$$\text{achievements} = 0.545 + 0.212 + 0.492 = 1.249 = 1.249$$

$$\text{ATCF} = 0.275 + 0.622 + 0.604 + 0.407 + 0.535 + 0.347 = 2.787$$

$$\text{ATFS} = 0.604 + 0.454 + 0.55 + 0.385 + 0.565 + 0.374 = 2.932$$

$$\text{ATL} = 0.351 + 0.345 + 0.298 + 0.508 + 0.608 = 2.11$$

Reability calculation:

$$\text{achievements} = \frac{(1.751)^2}{(1.751)^2 + 1.249} = 0.711$$

$$\text{ATCF} = \frac{(3.213)^2}{(3.213)^2 + 2.787} = 0.787$$

$$\text{ATFS} = \frac{(3.068)^2}{(3.068)^2 + 2.932} = 0.762$$

$$\text{ATL} = \frac{(2.89)^2}{(2.89)^2 + 2.11} = 0.798$$

The calculation of non-contraction above shows that the indicators of the research construct have a standard of ≥ 0.70 , so all of them have good variants.

Variance Extracted

Variance extracted This involves the sum of the variances of the indicators extracted by the variables whose form was developed. The magnitude of the extracted variance is obtained by the formula:

$$\text{Variance Extracted} = \frac{(\sum \text{Standardized loading})^2}{(\sum \text{Standardized loading})^2 + \sum \varepsilon_j}$$

SUM of *squared standardized loading*

$$\text{achievements} = 0.455^2 + 0.788^2 + 0.508^2 = 1.251$$

$$\text{ATCF} = 0.728^2 + 0.378^2 + 0.396^2 + 0.593^2 + 0.465^2 + 0.653^2 = 2.948$$

$$\text{ATFS} = 0.396^2 + 0.546^2 + 0.45^2 + 0.615^2 + 0.435^2 + 0.626^2 = 2.927$$

$$\text{ATL} = 0.649^2 + 0.655^2 + 0.702^2 + 0.492^2 + 0.392^2 = 2.196$$

Calculation of variance extracted

$$\text{achievements} = \frac{1.251}{1.251 + 1.242} = 0.502$$

$$ATCF = \frac{2.948}{2.928 + 2.497} = 0.505$$

$$ATFS = \frac{2.927}{2.927 + 2.885} = 0.503$$

$$ATL = \frac{2.196}{2.196 + 2.096} = 0.512$$

The calculation of the Variance Extracted above shows the indicators of the research contract have a standard of standart ≥ 0.50 , so all of them have good validity

CONCLUSIONS

The achievement model has 3 relationships of three variables related to self-performance where the data analysis results are obtained as follows: Achievement coefficient with SKD of 0.044, with SKSM of 0.063, SKFK of 0.19 which also includes low-performance coefficient as well as achievement relationship of 0.063. The coefficient of the SKFK is 0.19 and this coefficient also includes a low coefficient of stability and if out of these 3 collations increases the coefficient of achievement with the SKFK which is able to approach to be a low coefficient where the coefficient is low if the coefficient is at intervals of 0.200–0.399.

REFERENCES

- Alessandro, B. (2018). *Digital Skills and Competence, and Digital and Online Learning*. Turin: European Training Foundation.
- Alex, Sobur. (2006). *Semiotika Komunikasi, Analisis Teks Media Suatu Pengantar Untuk Analisa Wacana, dan Analisis Framing*. Bandung: PT Remaja Rosdakarya
- Almeida, F., & Simoes, J. (2019). *The Role of Serious Games, Gamification and Industry 4.0 Tools in the Education 4.0 Paradigm*. *Contemporary Educational Technology*, 10(2), 120–136.
- Br Ginting D. 2009. *Structural Equation Model*. 8: 1-14.
- Chaplin, J. P. (2008). *Kamus Lengkap Psikologi*. Jakarta: Rajagrafindo Persada.
- Djamarah, Syaiful Bahri. 2011. *Psikologi Belajar*. Jakarta : Rineka Cipta
- Dwi Siswoyo. Dkk, 2007, *Ilmu Pendidikan*, Yogyakarta: UNY Press. Hasibuan & Moedjiono, 2006, *Proses Belajar Mengajar*, Bandung: PT Remaja Rosdakarya
- Fattah Nanang. 2004. *Prinsip-prinsip Manajemen*. Jakarta: Bina Aksara
- Ghozali, I. 2004. *Model Persamaan Struktural: Konsep dan Aplikasi dengan Program Amos 19.0*. Semarang: Badan Penerbit Universitas Diponegoro.
- Hox, J.J & Bechger, T.M. 1998. *An Introduction to Structural Equation Modeling Family Science Review*, 11: 354-373.
- Kerlinger. 2004. *Variabel Independen dan variabel dependen*. 58-59

Khoirunisa A. 2020. *Pembelajaran jarak jauh*, 1-6.

Latumeten R, A Yopi, Y Francis. 2018. *Penggunaan Structural Equation Modeling (SEM) untuk menganalisis faktor yang mempengaruhi loyalitas nasabah*, 15 (2):76-83.

Mather, M., & Sarkans, A. (2018). *Student Perceptions of Online and Face-to-Face Learning*. *International Journal of Curriculum and Instruction*, 10(2), 61–76.

Mustofa, M. I., Chodzirin, M., Sayekti, L., & Fauzan, R. (2019). *Formulasi Model Perkuliahan Daring sebagai Upaya Menekan Disparitas Kualitas Perguruan Tinggi*. *Walisongo Journal of Information Technology*, 1(2), 151.

Mulder J, Hamaker E. 2020 *Three Extensions of the Random Intercept Cross-Lagged Panel Model*, 28(4): 638:648.

Pilkington, O. A. (2018). *Active Learning for an Online Composition Classroom : Blogging as an Enhancement of Online Curriculum*. *Journal of Educational Technology Systems*, 47(2), 1–14.

Riaz, A. (2018). *Effects of Online Education on Encoding and Decoding Process of Students and Teachers*. *International Conference E-Learning*, 42–48.

Riyani R, 2012. *Faktor yang mempengaruhi prestasi belajar mahasiswa*. (8):19-25.

Tirta I Made, Holipah, Angraeni Dian. 2019. *Analisis Structural Equation Model (SEM) dengan multipl r group menggunakan R*. 85-94.

Vegelius j, Shaobo J. 2021 *A semiparametric Approach for Structural Equation Modeling with ordinal Data*, 28(4): 409-505.