Structural Equation Modelling: The Affecting of Learning Attitude on Learning Achievement of Students

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Abstract. Student can obtain the high learning achievement because some factors. Those factors can appear from themselves or out of themselves. One of them is learning attitude of student. Learning attitude could be observed by some indicators. There were four indicators of learning attitudes, which were honesty, responsibility, discipline, and tolerance. The good learning attitude will give effect to learning achievement. Learning achievement is result of the learning process. There are several indicators to find out about students learning achievement. They are GPA, understanding of the concept, application and analysis. Learning achievement and learning attitude are unobserved variable, called latent variables. The method was used to analysis the latent variable in this research that was Structural Equation Modelling (SEM). It is combination from factor analysis, path analysis and regression. The aim of this research was to known affecting indicators from learning attitudes to learning achievement. The result showed that indicators of learning attitude had t-value more than 1.96 and that mean all of indicators in learning attitudes gave effect to the learning achievements.

1. Introduction

Learning is the process of gaining knowledge. The learning process can take place at school, campus or informal institutions. There are many methods for transferring knowledge from lecturers to students and there are many source of learning that can be accessed by students. Learning methods and resources are used to obtain learning outcomes in accordance with what has been targeted.

In the academic, a reflection of the achievement student learning can be seen from the results of quizzes and examinations, then accumulated and it is showed in the form of a Grade point average (GPA). The student GPA, especially first year student, will indirectly describe the academic achievements of the learning process that has been passed in first year level. This is certainly a challenge for first year level students, besides having to go through a transition period from high school to college, and the student must adapt with system in the campus.

Learning achievement is a reflection of the learning process in the past. GPA per semester can be a reference about learning achievement of college students. On the other hand, how students understanding the concept, how to apply the concept to solve the problems and doing problem analysis are important too. They can be reference learning achievement either. Based on Understanding concept, applying the concept, analysis ability of the college students and GPA, the student achievement can be measuring. They will be indicators to find out how students achievement are.

In the learning process, as a new student in college, there are several factors that will influence the learning process and ultimately it will affect learning achievement of the student.

There are some factors affect learning achievement. One of them is the internal factor. It is mean that factor appear from the students by themselves. Learning attitudes are one of the factors. Learning
attitudes are attitudes shown by students when the learning process, such as an attitude of responsibility, honesty, discipline, and tolerance. That factor cannot be directly calculated because there is no the direct measuring instrument to know it. Using indicators are the way to measuring them. They are unobserved variable, called latent variables.

Structural equation modelling (SEM) is a combination of factor analysis and path analysis. SEM can produce estimates of the relationship between several exogenous variables and endogenous variables with many indicators or latent variable. SEM also use for testing and confirming the models. In this research, SEM will be used for analysing the effect of student attitudes on learning achievement. There are four indicators of latent student attitude variables, namely responsibility, honesty, discipline, and tolerance. And there are indicators for learning achievement, that are GPA, ability of understanding concept, ability of applying concept and ability of analysing. The aims of this research is analysing the effect of student learning attitudes on learning achievement and to know what indicators that have impact to latent variable.

2. Basic Concept and Model

2.1. Learning Achievement

Embedding Learning is an important process to change the behaviour a person. To measure whether student has learned, a comparison is needed between the behaviour before and after learning process. Behaviour is a real reflection that is seen in attitudes, actions, and words (statements) as a reaction of student who arises because of the learning process and stimulation from the environment [5].

Learning achievement is a knowledge that student achieve while learning process. Learning achievement in academic is about how the student understanding the concept. Learning achievement is a change in student behavior that got after learning process [4]. The factors that influence learning achievement are classified into two groups, namely factors internal and external factors. Internal factors come from students, which include intelligence, attention, talent, interest, motivation, maturity, and readiness. External factors come from outside the students themselves, including the family environment, school environment, and community environment [6].

In this research, learning achievement would be exogenous variable (Y). Learning achievement would be measurement with four indicators, namely GPA (Y1), ability of understanding concept (Y2), ability of applying concept (Y3) and ability of analysis (Y4).

2.2. Learning Attitude

Attitude is a relatively similar tendency to act good or bad about someone or something. The attitude has the big impact to learning achievement. Attitude can be built by social interaction. Building and changing attitude are affected on some factors, such as personal experience, culture, self-esteem, social media, appreciation, education and emotion [8].Good attitude in learning process will lead the student to achieve the learning purpose. Learning attitude is the attitude that student showed in learning process and attitude that student had after learning process.

There are 4 indicators of learning attitude, that are responsibility, honesty, discipline, and tolerance [7]. In this research, that indicator would be used for measurement the learning attitude.

2.3. Structural Equation Modelling (SEM)

SEM is the second generation of multivariate analysis that combines factor analysis and path analysis. SEM can be used for analysing and testing exogenous and endogenous variables simultaneously with all their indicators [2]. SEM is usually used in research of social, economic, psychology, politic and education because SEM can explain the relation among latent variables. The reason that SEM uses to describe the relationship among the latent variables is to explain the covariance of variable [3].

There are 2 types of variables in SEM, namely latent variables and observed variables. Latent variables are variables that cannot be measured directly, and they are observed indirectly from observed variables. Latent variables are divided into two categories: exogenous variables and endogenous variables. While observable variables are variables that can be observed directly and they are called indicators of latent variables.
There are two models that build structural equation modeling, namely structural models and measurement models. The general form of the structural model equation:

\[ \eta = \beta \eta + \Gamma \xi + \zeta \]  

Where:

- \( \eta = p \times 1 \) vector of dependent latent variable (endogenous variables)
- \( \xi = q \times 1 \) vector of independent latent variable (exogenous variables)
- \( \beta = \) matrix coefficient of \( \eta \) size \( m \times m \)
- \( \Gamma = \) matrix coefficient of \( \xi \) size \( m \times n \)
- \( \zeta = p \times 1 \) vector of error in equations

\[ y = \Lambda \eta + \varepsilon \]  

\[ x = \Lambda \beta + \delta \]

2.3.1. **Evaluation of goodness of fit**

- **Measurement Model.** Measurement models or outside models show how the observed variables represent the latent variables being measured. It is from confirmatory factor analysis by testing its validity and reliability. Validity testing is used to analysis internal validity test that shows the ability of research instruments to measure what should be measured from a concept [2]. The testing is done by confirmatory analysis using MTMM (Multi Trait- Multi Method) which discusses convergent and discriminant validity. Convergent validity test on LISREL can be seen from the loading factor value for each construct indicator. The rule of commonly used for convergent validation values is factor loading values is more than 0.7. In addition to the validation test, Reliability test is the measurement model that used. Reliability tests are carried out to prove the consistency and accuracy of the instruments in construct measurement. There are two ways to test
reliability, namely the reliability of Cronbach’s alpha and Composite. For the Cronbach’s Alpha test, SPSS software can be used. A good reliability test value is more than 0.7 [2]. In this paper, the validity test used is convergent validity test. Consider the factor loading value using the LISREL software and for the reliability test considered with Cronbach’s Alpha.

- **Goodness of FIT.** In the structural model analysis, there is no single statistic to measure or test the model hypothesis. Goodness of fit is an indication to determine the model is good or bad [2]. Overall there are three types of measures of goodness of fit in table 1.

| Table 1 | is indicator of fitting model |
|---------|------------------------------|
| No. | Indicator | Cut off Value |
| 1 | P-value | close to zero |
| 2 | RMSAE | < 0.80 |
| 3 | AGFI | ≥ 0.90 |
| 4 | CFI | ≥ 0.95 |
| 5 | GFI | ≥ 0.90 |
| 6 | NFI | ≥ 0.90 |

3. Application and Discussion

3.1. Data

Learning attitude was an exogenous variable and it had four indicators. Learning achievement was an endogenous variable and had four indicators. The data was collected from college student in Mathemetic and natural science faculty, Universitas Negeri Padang. There were 250 respondents from first year student in college. The sample was collected by simple random sampling method. Sample were representative to the population because the sample came from different department in this faculty.

| Table 2 | Latent Variables and indicatos |
|---------|-------------------------------|
| No | Latent Variables | Indicators |
| 1 | Learning Attitudes | Responsibility(x1) |
| | | Honesty (x2) |
| | | Discipline (x3) |
| | | Tolerance (x4) |
| | | GPA (y1) |
| 2 | Learning Achievement | Understanding concept (y2) |
| | | Applying the concept (y3) |
| | | Analysis ability (y4) |

In this research, SEM has used for analysing the effect of learning attitude on learning achievement of the first year student in the college.

3.2. Result

3.2.1. Model Structural and Measurement Model

Windows The information that obtained from SEM analysis was information structural model and measurement model. There were information about loading factor value, and t-value. Loading factor
values less than 0.5 are indicated that indicators did not have significant effect to the latent variable. Loading factor value gave information about indicator that had significant effect.

Based on figure 2, the loading factor value $x_1$ was 0.75, the loading factor value $x_2$ was 0.7 and 0.69 and 0.66 to loading factors value $x_3$ and $x_4$. It means all of indicators could be measurement of student attitude. The endogen variable was student achievement. The loading factor value from $y_1$, $y_2$, $y_3$, and $y_4$ respectively are 0.16; 0.64; 0.69; and 0.63. The loading factor value $y_1$ less than 0.6, it meant the indicator GPA could not be measurement of student achievement.

![Figure 2. Loading factor value](image)

Measurement model from figure 2 based on loading factor value could be written as an estimation:

$$
X1 = 0.75*X \quad Y1 = 0.16*Y
$$

$$
X2 = 0.70*X \quad Y2 = 0.64*Y
$$

$$
X3 = 0.69*X \quad Y3 = 0.69*Y
$$

$$
X4 = 0.66*X \quad Y4 = 0.62*Y
$$

And the structural model was:

$$
Y = 0.31*X
$$

Beside of loading factor value, the significant effect of indicator also could be saw from estimation $t$-value. If the $t$-value of the indicators more than 1.96 (alpha 5%), the indicator had significant effect to latent variables. Figure 3 was $t$-value of the indicator variable to its latent variable and $t$-value from learning attitude to learning achievement of student. Indicator Y1 did not give significant effect to the learning achievement, and the other indicators had the significant effect to learning achievement (Y) because they had $t$-value more than 1.96. The indicators of learning attitude (X) gave the significant effect either. They had $t$-value more than 1.96. And the learning attitude had significant effect on learning attitude.
3.2.2. Evaluation of goodness of fit

The goodness of fit of this analysis was in table 3. P-value was almost zero, AGFI value was 0.90, CFI was more than 0.95, GFI value was 0.95, and NFI value was more than 0.90. Based on that information, it got information that the analysis produced the good model.

| No | Indicator   | Value |
|----|-------------|-------|
| 1  | P-value     | 0.0001|
| 2  | RMSAE       | 0.08  |
| 3  | AGFI        | 0.90  |
| 4  | CFI         | 0.96  |
| 5  | GFI         | 0.95  |
| 6  | NFI         | 0.94  |

4. Conclusion

The analysis of learning attitude on learning achievement of the student using SEM obtained the good model based on the criteria of goodness of fit. T-value showed that the indicators of latent variable have the significant effect to the latent variable. And the learning achievement was affected on learning attitude because it had the t-value more than 1.96.

There are indicators that do not have a significant effect on latent variables. That is an indicator of learning achievement. The indicator is grade point average (GPA). T value of GPA is less than 1.96 and the loading factor is 0.16. GPA does not have a significant effect on learning achievement variables. In this study, the GPA cannot be a reflection of learning achievement. That cannot be a measurement of learning achievement. So indicators that can be a measurement of learning achievement as endogenous variables, are concept understanding (Y2), applying concepts (Y3) and analysis (Y4).

The indicators of variable learning attitude gave the significant effect to their latent variable. They had loading factor values more than 0.5 and t-value more than 1.96. So in this research, responsibility (X1), honesty (X2), discipline (X3) and tolerance (X4) could be measurement of the learning attitude.

5. Acknowledgements

The authors gratefully acknowledge to the respondent and all supporting team.
6. References

[1] Bollen K A 2011 Evaluation effect, Composite, and Causal Indicators in Structural Equation Models *MIS Quarterly* **35** 359-372

[2] Latan H 2013 *Model Persamaan strukturan teori dan implementasi AMOS 21.0* Bandung: Alfabeta

[3] McQuitti S & Wolf M 2013 Structural Equation Modeling: A Practical Introduction *Journal of african Bussines* **14** 58-69

[4] Anni, Catharina T, et al. 2010 *Psikologi Blejar* Semarang: UNNES PRESS

[5] Tu’u T 2014 *Peran Disiplin dan Perilaku Belajar Siswa* Jakarta: Gramedia Grasindo

[6] Slameto 2010 *Belajar dan Faktor-faktor yang Mempengaruhinya* Rineka Cipta

[7] Iskak M 2007 *Pengaruh Sikap Belajar dan Motivasi Belajar Siswa Terhadap Prestasi Belajar Ilmu Pengetahuan Sosial* Jakarta: Wade

[8] Azwar S 2008 *Tes Prestasi: Fungsi dan Pengembangan Pengukuran Prestasi Belajar* Yogyakarta: Pustaka Pelajar