Application of Structural Equation Modeling – Generalized Structured Component Analysis (SEM - GESCA) (Case Study: Multiple Intelligences SMAN 1 Rumpin-Bogor)

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ABSTRACT

Structural Equation Modeling (SEM) is a method that can be used to analyze the data that can not be measured directly. One of SEM methods is Generalized Structured Component Analysis (GSCA). The data used in the research is primary data taken from taken from SMAN 1 Rumpin Bogor. The purpose of this paper is to examine the influence of parent's parenting and learning method on learning motivation and multiple intelligences which are the most influential on the students. Multiple intelligences by Gardner in 1983 divided into eight intelligences ie linguistic, log-mathematical intelligence, spatial intelligence, kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence and naturalist intelligence. The result of analysis showed that the parent's parenting gave significant influences to log-mathematical intelligence, kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence, naturalistic intelligence and learning motivation whereas learning method only gave significant influence to kinesthetic intelligence and musical intelligence.

Keywords--- Multiple Intelligences, SEM-GSCA

I. INTRODUCTION

School is a facility to search and study. A student can be said to be intelligent when the student can master the mathematical sciences or verbal. According to Gardner (1983) in his book Frames of Mind Gardner multiple intelligences itself split into eight parts: linguistic, musical intelligence, intelligence logical - mathematical, visual intelligence, kinesthetic intelligence, interpersonal intelligence, intrapersonal intelligence, natural intelligence.

Verbal-Linguistic Intelligence is the intelligence associated with an interest in writing techniques and storytelling (Nicholsonet al. 1998).Musical intelligence is an intelligence interconnected, to deepen their interests or hobbies related to music (McKenzie 2005).Visual-spatial intelligence, according Nicholsonet al. (1998) Students who have visual-spatial intelligence are students who have a strong visual memory in activities of describing, expressing, explaining the pictures, perform, and manufacturing concepts. They are easier to understand science as they can visualize that they learned into spatially.

Kinesthetic intelligence is the intelligence refers to the ability of a individual to use the body to express themselves, in general, people who have this capability can handle the physical objects skillfully. Someone who has this intelligence does not only affect the health and fitness, but it is also important to raise the power of the mind. Students conditions in the classroom is to siting for hours and asked to paying attention to verbal input. Human needsof moving completely ignoring,Therefore, sometimes the potential value to create higher energy levels and maintain the attention is greatly reduced (Morgan et al 2004).

The intelligence of mathematical logical refers to the sensitivity of individuals to distinguish logical or numerical patterns and the ability to handle a complex reasoning. These people like to experiment, solve puzzles, and ask cosmic.Questionsstrength in mathematical intelligence often implies a big scientific capabilities (Lunenburget al 2014).Interpersonal intelligence is the intelligence in relation to undergo another person. According to Fleetham (2006) in his book of Multiple Intelligences in practice that people who have interpersonal intelligence have several capabilities including encouraging collaborative working groups and discussions, emotional intelligence model, show an interest in the lives of students outside the school and Share kehidupand and outside school with learners.Intrapersonal intelligence is intelligence in control of his own personality from a selfish sense. Intrapersonal intelligence is intelligence that reflects the ways to control their own feelings and moods, pursue personal interests and set the agenda of individuals, learning through observation and listening, using

metacognitive skills (Hoerr 2000). Natural intelligence is the intelligence of the people who have this intelligence in general to understand something by individual sort, first organize, categorize, compare, differentiate, classify, align, organize, sort, group, map the they learned (McKenzie 2005).

SMAN 1 Rumpin is one school located in the western region of Bogor is located at Jalan Abdullah Prada Rumpin village with Agrade of accreditation. SMA Negeri 1 Rumpin in the academic year 2015/2016 529 students. XII grade students divided into 4 (four classes) with the number of 141 students, class XI student is divided into 5 (five classes) with the number of 183 students, and the students of class X, there are 6 (six classes) with the number of 215 students. SMAN 1 Rumpin is the only public school in the area Rumpin but student achievement in this schoolis not much different from private of schools in the area of Rumpin.

To see the dominant intelligence on the multiple intelligences of students of SMAN 1 Rumpin based on theory Gardnertheory then the data obtained during the study can not be measured directly. The data can not be directly measured can not be used with the usual methods like datawhich can bemeasured directly, and therefore a certain method is required.

Some researchers have previously tried to use multiple intelligences to see what factors are most influential for each school that will be investigated. Previousresearchers from turkey Yalmanci et al (2013) from the faculty of education to apply the method of multiple intelligences. The research looked at every

aspect of the multiple intelligences of students of SMAN 1 Rumpin by modeling intelligence which is most significant. StructuralEquational Modeling (SEM) is a method that can handle data that can not be measured directly. SEM has several methods such as Generalize Structured Components Analysis (GSCA). GSCA constructed of three sub-models: the structural model, the measurement model, and the weightingmodel. Weighting models that exist in GSCA weighting is functioning to combine models and structural models that exist in GSCA own.

The purpose of this study was to model the relationship between learning motivation, parenting parents, methods of learning and multiple intelligences Grade 3 SCIENCE and SOCIAL SMAN 1 Rumpin by applying the model SEM-GSCA

II. METHODOLOGY DATA

The data used in this study are primary data through surveys at SMAN 1 Rumpin. for 4 weeks starting from March 8 to 2 April 2016. The survey was conducted on the students of class XII SMAN 1 Rumpin the academic year 2015/2016 for all third grade students of SMAN 1 Rumpin. To identify the multiple intelligences of students then questionnaires is used by roger indicator of multiple intelligences which has been adapted intobahasa.The variables used in this study can be seen on Table 1 below:

Table 1 Factors used as the basis for analysis

Data	Variable	Indicators
x.1	Linguisticintelligence (LI)	4 Indicators
x.2	log-mathematicalIntelligence (LmI)	4 Indicators
x.3	SpatialIntelligence (SI)	4 Indicators
x.4	KinestheticIntelligence (KI)	4 Indicators
x.5	Musical Intelligence (MI)	4 Indicators
x.6	interpersonal Intelligence (IeI)	4 Indicators
x.7	intrapersonalIntelligence (IaI)	4Indicators
x.8	NaturalistIntelligence (NI)	4 Indicators
x.9	Pattern foster parent (PfP)	9 Indicators
x.10	learning method (LM)	2 Indicators
x.11	Motivation to learn (ML)	5 Indicators

Research Methods

In this study, there are several steps in the process of analyzing the data. These steps are as follows:
1. Exploration of Data
2. Analysis of structural equation model with SEM-GSCA at the analysis stage:
   a. Getting the concept and theory-based model and create the path diagram
   b. Converting path diagram into equation
   c. Predicting the parameters of weight of estimators, estimators loading factor, estimators bootstrap path coefficients and the estimated standard error

d. Determining the coefficient of parameter and the value of t by using bootstrap
e. Testing the significance of the parameters in the measurement model
$$Z_i = C'\eta_i + \varepsilon_i$$

Note :
Z be an indicator measuring the vector of j * 1
C 'is a matrix of vector measuring loading p * j
η is a of latentvector variables p * 1
ε_j a residual vector of indicators measuring J * 1
f. Testing the significance of structural parameters in the model
$$\eta_y = \beta'\eta_x + \xi_i$$

Note :

β 'is matrix T * T for the path coefficient linking latent variables

ξ_i an error vector on ηi measuring T * I

η_x is a latent variable that affects the η_y, η_x Vektor measuring T * 1

η_y is a latent variable that is affected by η_y, η_x Vector measuring T * 1

         g.   Determining goodness overal fit model

III.   RESULTS AND DISCUSSION

The biplot analysis(Gabriel 1971) is one measure that can be used to show the distance between units and groups as well as variations in the appearance and correlation of the variables used. Biplot also be used to create an image that many dimensions and used as two-dimensional. Information that can be obtained from the biplot analysisis the proximity between objects, making it easier to group objects based on similar characteristics. Biplot analysis process used to determine the variance of multiple intelligences to all students in third grade (3) of SMAN 1 Rumpin. The results of the biplot analysiscan be seen in Figures 1 and 2 below:
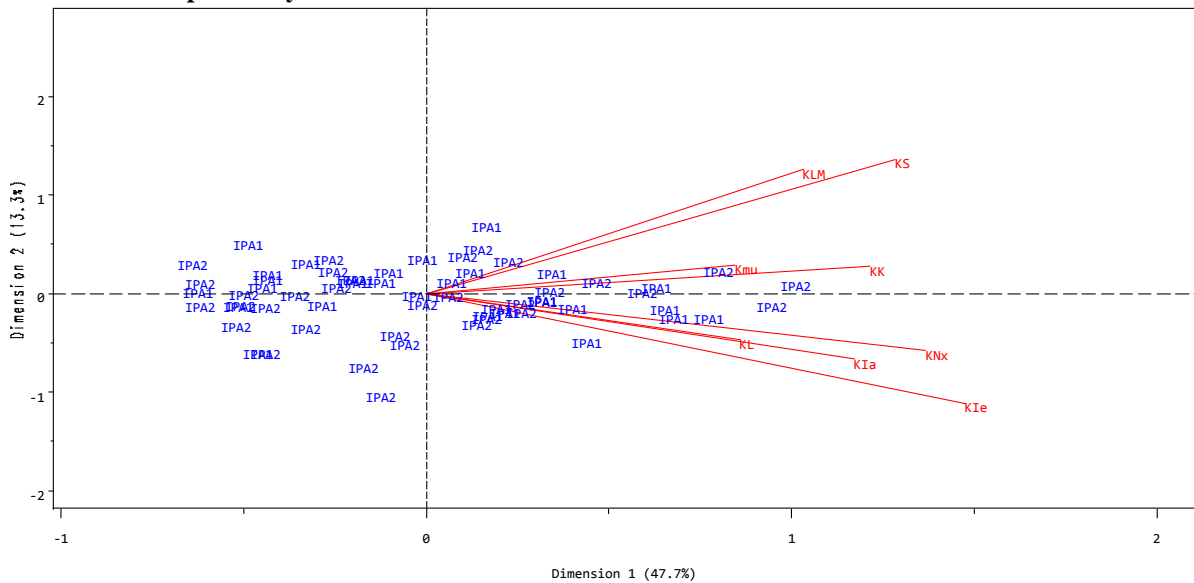

Figure 1. the biplot analysis of science class students of SMAN 1 Rumpin

Based on Figure 2 note the distribution of the variance of science class is random and some students of science class is away from variable used, making it difficult weeks to see the variance of the variable whose value is almost the object of research (science class student).
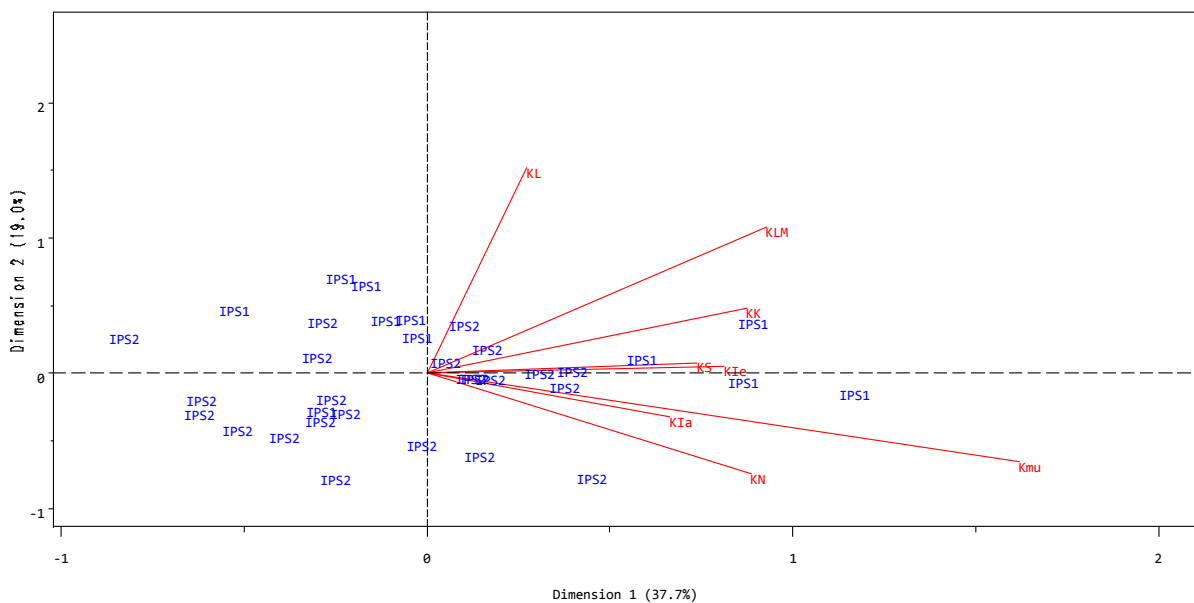

Figure 2. the biplot analysis of social class grade students of SMAN 1 Rumpin

The variance among students in social class studentSMAN 1 Rumpin the variable used is small is shown in Figure 2. Results Figures 1 and 2 also show that the pattern of variance of students in grade science and social studies on the variables used is relatively the same. To see the variance of students' science and social studies can further be used by test Analysis of Variance (ANOVA).

Different test Analysis of Variance (Anova)

Based on data from the survey results revealed that there are different populations, population of science class and social class. Tests ANOVA was used to see if there are differences in variance between 2 classes science and social class. The hypothesis is as follows:

$H_0 : \beta_i = \beta_j$

$H_1 = \beta_i \neq \beta_j$

Description :

β_i = Science Class

β_j = Class social

According to the table 1 below,variance is not significant so that the model class for science and socialclasses should be used as a model of the variables used while it is known that P-Value <0.05%, so that the effect of the variable is declared is no difference between variables.

Table 1. The influence of different test

Effect	P-Value
Class	0,278
Variabel	0,001

Exploration of Data

Based on the survey results revealed that the number of students of science class is more than socialclass. Based on Figure 3, number of students in grade science 63 people than students social class is only 34.
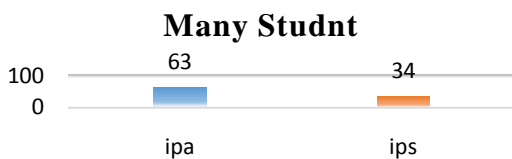

Figure 3. Comparison of a lot number of students in grade science and social studies class SMAN 1 Rumpin. The mean ofvariance of the multiple intelligences of students of SMAN 1 Rumpin to grade science and social studies class the multiple intelligences

of students of SMAN 1 Rumpin thoroughly dominated by naturalist at 3.34 while the smallest was 2.94 intrapersonal intelligence.
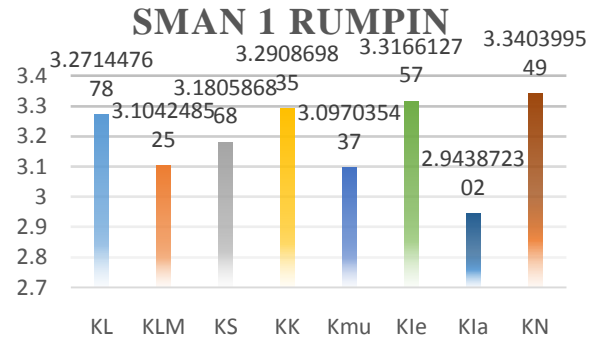

Figure 2. Average the multiple intelligences of students of SMAN 1 Rumpin

Measurement Model

Reliability is a method used to measure the consistency of the research instruments. Reliability in the selection of the measurement model is determined based on the value of the square root of the average variance value (AVE), which is the value of the loading factor. The reliability value obtained on the basis of the output results indicate the software used Cronbach alpha values > 0.7 of each indicator that the overall value of the loading factor for multiple intelligences third grade students of SMAN 1 Rumpin ie log-mathematical intelligence 0.779, 0.718 spatial intelligence, 0.825 musical intelligence, interpersonal intelligence 0.816, 0.710 intrapersonal intelligence, naturalistic intelligence 0.778 and 0.838 parenting parents.

General measurement model third-grade students of SMAN 1 Rumpin determined based on the square root AVE latent variable value if the value of the root AVE> latent correlation between the variables it can be said that the resulting model quite nice. The value of the square root of linguistic intelligence 0.693, intelligence log-mathematical .780, spatial 0.739, kinesthetic intelligence 0.677, musical intelligence 0.812, interpersonal 0.804, intrapersonal intelligence 0.736, naturalist 0.777, parenting parents 0.672, learning methods 0.819 and motivation learning 0.691. Value latent correlation matrix between the variables can be seen in table 2 below:

Table 2. Matrix of correlations between variables

	Correlations Of Latent Variables (Se)										
	Linguistic intelligence	Log-mathematical Intelligence	Spatial Intelligence	Kinesthetic Intelligence	Musical Intelligenceal	Interpersonal Intelligence	Intrapersonal Intelligence	Naturalist Intelligence	Pattern foster parent	Learning method	Motivation to learn
Linguistic intelligenc	1	0.223 (0.141)	0.246 (0.106)*	0.360 (0.107)*	0.066 (0.102)	0.244 (0.094)*	0.227 (0.092)*	0.181 (0.102)	0.193	-0.031 (0.111)	0.238 (0.085)*

e								(0.105)		
Log-mathematical Intelligence	1	0.438 (0.100)*	0.426 (0.074)*	0.166 (0.099)	0.304 (0.080)*	0.294 (0.087)*	0.278 (0.100)*	0.271 (0.085)*	0.163 (0.132)	0.389 (0.067)*
Spatial Intelligence		1	0.555 (0.086)*	0.362 (0.073)*	0.214 (0.116)	0.206 (0.079)*	0.416 (0.086)*	0.188 (0.101)	0.069 (0.118)	0.266 (0.084)*
Kinesthetic Intelligence			1	0.416 (0.085)*	0.456 (0.100)*	0.262 (0.101)*	0.465 (0.075)*	0.271 (0.086)*	0.220 (0.130)	0.360 (0.087)*
Musical Intelligenceal				1	0.277 (0.088)*	0.264 (0.095)*	0.284 (0.101)*	0.308 (0.087)*	0.174 (0.114)	0.156 (0.094)
Interpersonal Intelligence					1	0.415 (0.085)*	0.534 (0.074)*	0.473 (0.100)*	-0.011 (0.107)	0.544 (0.071)*
Intrapersonal Intelligence						1	0.447 (0.084)*	0.456 (0.088)*	-0.027 (0.112)	0.580 (0.064)*
Naturalist Intelligence							1	0.436 (0.105)*	0.031 (0.117)	0.505 (0.071)*
Pattern foster parent								1	-0.117 (0.102)	0.378 (0.080)*
Learning method									1	-0.040 (0.121)
Motivation to learn										1

Structural Model

Path analysis of SMAN 1 Rumpin known that parenting parents can affect the log-mathematical intelligence, kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence, naturalistic intelligence and motivation to learn. Parenting foster parent does not affect linguistic intelligence, spatial intelligence, methods of learning while learning method only affects intelligence kiestetik and musical intelligence but does not affect linguistic, intelligence log-mathematical, spatial, interpersonal, intrapersonal intelligence, naturalistic intelligence and motivation learn. Path analysis on the students of SMAN 1 Rumpin can be seen in Table 3 below

Table 3. path analysis SMAN 1 Rumpin

Path Coefficients			
	Estimate	SE	CR
Parenting parents->Linguistic Intelligence	0.192	0.106	1.81
Parenting parents->Log-Matematis Intelligence	**0.294**	**0.084**	**3.51***
Parenting parents->Spasial Intelligence	0.198	0.101	1.97
Parenting parents->Kinestetik Intelligence	**0.301**	**0.081**	**3.73***
Parenting parents->Musical Intelligence	**0.333**	**0.084**	**3.97***
Parenting parents->Interpersonal Intelligence	**0.478**	**0.105**	**4.57***
Parenting parents->Intrapersonal Intelligence	**0.460**	**0.090**	**5.13***
Parenting parents->Naturalist Intelligence	**0.446**	**0.102**	**4.38***
Parenting parents->Learning Method	-0.117	0.102	1.15
Parenting parents->Motivation to Learn	**0.378**	**0.082**	**4.6***
Learning Method->Linguistic Intelligence	-0.008	0.105	0.08
Learning Method->Log-Matematis Intelligence	0.197	0.119	1.66
Learning Method->Spasial Intelligence	0.091	0.109	0.84
Learning Method->Kinestetik Intelligence	**0.256**	**0.121**	**2.11***
Learning Method->Musical Intelligence	**0.213**	**0.101**	**2.12***
Learning Method->Interpersonal Intelligence	0.045	0.104	0.43
Learning Method->Intrapersonal Intelligence	0.027	0.102	0.26
Learning Method->Naturalist Intelligence	0.084	0.108	0.78
Learning Method->Motivation to Learn	0.004	0.113	0.04

Here is a structural model for the intelligence of SMAN 1 Rumpin:

Table 4. Matrix of path analysis SMAN 1 Rumpin

$$\begin{bmatrix} LI \\ LmI \\ SI \\ KI \\ MuI \\ IeI \\ IaI \\ NI \\ LM \\ ML \end{bmatrix} = \begin{bmatrix} 0.192 & -0{,}008 \\ 0{,}294 & 0{,}197 \\ 0{,}198 & 0{,}091 \\ 0{,}301 & 0{,}256 \\ 0{,}333 & 0{,}231 \\ 0{,}478 & 0{,}045 \\ 0{,}460 & 0{,}027 \\ 0{,}446 & 0{,}084 \\ -0{,}117 & 0 \\ 0{,}378 & 0{,}004 \end{bmatrix} \begin{bmatrix} PP \\ LM \end{bmatrix} + \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \\ \xi_4 \\ \xi_5 \\ \xi_6 \\ \xi_7 \\ \xi_8 \\ \xi_9 \\ \xi_{10} \end{bmatrix}$$

In Table 4 shows that linguistic intelligence was positively related to parenting parents while the method of learning has a negative correlation, intelligence log-mathematical, spatial, spatial, kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence, naturalist intelligence and, learning motivation was positively related to parents' parenting and learning methods negatively affect parenting parents. Interpersonal intelligence is a latent variable that has the greatest R^2 when compared with other latent variables. R^2 interpersonal intelligence amounted to 0.226, which means that the variance of interpersonal intelligence that is able to be explained by the parents' parenting and learning methods applied by the school was 22.6% and the rest can be explained by other latent variables that are not included in the model. Based on Figure 4 also known that from eleven latent variables are used known that learning is a method that has a variable R^2 is the smallest compared with other variable that is equal to 0.043.

Evaluation of Best Model

Evaluation models can best be seen in Table 5 based on the FIT which is a measure of the magnitude of the variance of all the variables that can be explained by the model, AFIT, the value of the square root mean error of standardized (SRMS) is getting closer to 0, the better the model used, and GFI is the opposite of SRMS is closer to 1, the better the model used. Thorough evaluation models known that the magnitude of the variance of the data to explain the model to the students of SMAN 1 Rumpin can be seen from the value of FIT is 0.461, the square root of the error standardized (SRMS) approaches a value of 0 is 0.132, the value of FIT which has been corrected by (Afit) 0.448 and the value of GFI approaches a value of 1 is 0,990.

Table 5. Evaluation of fitness model SMAN 1 Rumpin

The size of the fitness model	Value
FIT	0.461
AFIT	0.448
GFI	0.990
SRMR	0.132

IV.   CONCLUSION

Intelligence dominant by students of SMAN 1 Rumpin is a naturalist intelligence. People who have a naturalistic intelligence is the kind of person who often differing, sorting, organizing, mapping what he learned. Naturalist people type more easily understand what is learned by observing in advance what will be studied for example if in math on the first geometry

given type of geometry that will be studied, and then ask what they have learned from the geometry.

The learning method used in this research is the method used by the students of SMAN 1 Rumpin in teaching and learning at all grade science and social studies, therefore, researchers suggest further research should apply the learning method is based on the way the intelligence of the type of compound to be measured to obtain better results

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