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Application of Generalized Structural Component Analysis to Identify Relation between Accreditation and National Assessment

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ABSTRACT

National Education Standards (SNP) is the minimum criteria set by the government in the education system. SNP serves as the basis of educational development strategy based on national evaluation result such as national assessment. SNP is a latent variable that cannot be measured. Currently, the causality of SNP is still in debate. There are several educational theories that explain the causality of SNP. This study employed the generalized structured component analysis to identify relationship between SNP and UNBK. Based on the evaluation of the measurement model, it was found that there were 11 indicators that were not significant out of 121 indicators in model. Based on the evaluation of the structural model, it was found that path coefficient of SI to PA was also not significant in model. Based on overall goodness of fit, the FIT value of model is 0.630 and AFIT value is 0.629 which mean that the total variant of all variables that can be explained by the model is 63% based on FIT value and 62.9% based on AFIT value. Based on the result on this study, we found that National Education Standards that have a significant effect on academic achievement are standard of competency (SKL), standard of process (SPR), and standard of assessment (SPN).

Keywords : Generalized Structured Component Analysis, National Education Standard, National Assessment

I. INTRODUCTION

National Education Standards (SNP) is the minimum criteria set by the Indonesian government in the education system. SNP has eight standards such as standard of content (SI), standard of process (SPR), standard of competency (SKL), standard of education and staff (SPT), standard of infrastructure (SSP), standard of management (SPL), standard of cost (SB), and standard of assessment (SPN). SNP was developed by National Education Standards Board (BSNP). One of the way to measure the fulfilment of SNP is the assessment made by the National Accreditation Board (BAN) such as accreditation. The BAN developed an instrument containing items of questions used to assess the eight SNP. One of the instruments to obtain accreditation is based on Regulation of the Minister of Education and Culture No. 003/H/AK/2017 about Criteria and Accreditation Tool of SMP/MTS.

The SNP serves as the basis of educational quality development strategy based on the result of national learning evaluation such as national test (UN). Raharjo (2014) explained that eight SNPs have an effect on the achievement of UN. The schools that high achievement of SNP are expected to have good UN score. Recently, the implementation of UN in Indonesia has been carried out in two forms namely the National Test based on Paper and Pencil (UNKP) and National Test based on Computer (UNBK).

SNP is a latent variable that cannot be measured. Instead, it is measured by instrument items. Eight standards of SNPs have a causality. One of the educational theories that explains the causality of SNP is published by the Ministry of Education and Culture (2017). One of analysis that can be used to measure the relationship between the latent variables or the

relationship between the latent variables and the indicator variables is structural equation modelling (SEM). Hox and Bechger (1999) explain that SEM is a multivariate technique developed to cover the limitations of the regression model, path analysis and confirmatory factor analysis. Research on the causality of SNP has been done by several researchers. Hijrah et al. (2018) explained the causality of SNP based on theory of Ministry of Education and Culture (2012) using partial least square path modeling (PLSPM). Ferezagia et al. (2015) explained the causality of SNP based on the theory of Ministry of National Education and Ministry of Religion (2010) using generalized structured component analysis (GSCA).

In general, there are two types of SEM i.e. covariance based SEM and variance/component based SEM. Covariance based SEM is strongly influenced by parametric assumptions such as the assumption of multivariate normal distribution and observation must be independent of each other (Ghozali and Kusumadewi 2016).

As an alternative of the covariance based SEM, component based SEM such as PLSPM and GSCA are able to avoid parametric assumption problems. But, the PLSPM has limitations in estimating parameters because it does not have an overall goodness of fit. It makes difficult to determine how well the model is and difficult to compare with alternative models (Ghozali and Kusumadewi 2016). Hwang and Takane (2004) offer GSCA as a solution to PLSPM weaknesses. The GSCA retains the excess of the PLSPM and is equipped with an overall goodness of fit. This study aims to identify the generalized structured component analysis model of relationship of SNP and UNBK.

II. METHODS

A. Data

The data to be used in this study is the result of accreditation and the result of UNBK in 2017. The data consists of 2069 schools at the junior high school in Indonesia. The data is the result of a combination of the results of accreditation consisting of 8465 schools and the results of UNBK consisting of 11047 schools.

The accreditation data consists of 124 questions (indicators) obtained from the Indonesian Ministry of Education's Research and Development Agency using a Likert scale of 0 to 4. The UNBK data consists of 4 indicators, namely English (ING), Indonesian Language (BIN), Mathematics (MAT) and Natural Sciences (IPA) obtained from the Education Research Centre. The variables used in this study are grouped into 9 latent variables.

B. The Stage of Analysis

The data analysis stages used are as follows:

1. Exploring data to provide an overview of the data of the result of accreditation and the result of UNBK.
2. Analysing structural equation models with GSCA, it consists of the following steps:
   a. Estimating parameters consisting of weight estimator, loading factor estimator, path coefficient estimator and standard error bootstrap estimation
   b. Test the validity and reliability by looking at:
      i. Reflective measurement model:
         a) Convergent validity: Loading factor values more than 0.70 and significant (Hwang Takane 2004).
         b) Discriminant validity: The square root value AVE of each latent is greater than the correlation value between other latent in the model (Fornell and Lacker 1981). AVE is obtained using the formula:

$$\text{AVE} = \frac{\sum \lambda i^2}{\sum \lambda i^2 + \sum (1 - \lambda i^2)}$$

         c) Composite reliability: The recommended value is greater or equal to 0.70 (Hair et al. 2010). Composite reliability is calculated using the formula:

$$\rho c = \frac{(\sum \lambda i)^2}{(\sum \lambda i)^2 + (\sum 1 - \lambda i^2)}$$

      ii. Formative measurement models were tested by looking at weight significance and conducting multicollinearity tests based on VIF values. The recommended weight significance is more than 1.96 and the VIF value is less than 10. (Hwang Takane 2004).
   c. Test the significance of parameters in the structural model by looking at the *t* test of parameters in the structural model and coefficient of determination (R^2).

d. Determine the overall goodness of fit model using FIT and AFIT. Both FIT and AFIT explain the amount of variance that can be explained. The greater the value of FIT and AFIT, the better the model. FIT and AFIT are calculated by the formula (Ryoo 2017):

$$FIT = 1 - \left[\frac{\sum_{i=1}^{N}(\boldsymbol{Vz_i} - \boldsymbol{AWz_i})'(\boldsymbol{Vz_i} - \boldsymbol{AWz_i})}{\sum_{i=1}^{N}(\boldsymbol{z_i'V'Vz_i})}\right]$$

$$AFIT = 1 - (1 - FIT)\frac{d_0}{d_1}$$

III. RESULTS AND DISCUSSION

A. Data Exploration

In general, the comparison of UNBK and UNKP data can be seen in Table I and Table II. Table I describes the correlation of UNBK and SNP scores based on 2017 accreditation results. The correlation of UNBK and SNP shows a strong positive correlation. This shows that the greater the value of SNP, the greater the value of UNBK. Table II describes the correlation of UNKP and SNP scores. The correlation of UNKP and SNP shows several negative correlation. Some of the negative correlation are the correlation between SI and ING and the correlation between SI and MAT. This shows that the greater the value of SNP, the smaller the value of UNBK.

TABLE I
CORRELATION MATRIX OF SNP AND UNBK

	BIN	ING	MTK	IPA
SI	0.43	0.31	0.32	0.36
SPR	0.45	0.37	0.36	0.4
SKL	0.47	0.4	0.38	0.41
SPT	0.34	0.29	0.29	0.32
SSP	0.52	0.42	0.41	0.45
SPL	0.45	0.36	0.36	0.4
SB	0.36	0.27	0.27	0.3
SPN	0.42	0.36	0.35	0.38

TABLE III
CORRELATION MATRIX OF SNP AND UNKP

	BIN	ING	MTK	IPA
SI	0.14	-0.03	-0.02	0.02
SPR	0.16	0.03	0.03	0.07
SKL	0.14	0.01	0	0.05
SPT	0.11	0.02	0.01	0.06
SSP	0.15	-0.03	-0.03	0.02
SPL	0.17	0	0.01	0.05
SB	0.11	-0.07	-0.07	-0.02
SPN	0.17	-0.01	0	0.04

Based on these results, this study focuses on data of the relationship between SNP and UNBK. The data to be used in this study consisted 877 SMP, 867 SMPS, 62 MTSN and 263 MTSS. The overall percentage of school with A, B, C, TT accredited are 58.48%, 35.23%, 6.09% and 0.19% respectively.

The percentage of school accreditation status based on the type of school can be seen in Figure 3. It appears that SMPN and MTSN tend to get A accredited with a percentage of 81.64% from 877 schools and 88.71% from 62 schools. Whereas SMPS and MTSS tend to get B accredited with a percentage of 49.13% of 867 schools and 55.51% of 263 schools. In addition C accredited and not accredited schools show a small percentage. This shows that most schools in junior high schools that apply UNBK are schools with accredited A and B.

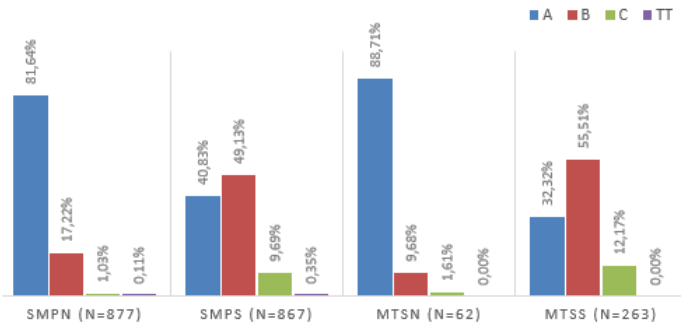

Figure 3: Accreditation status based on the type of school

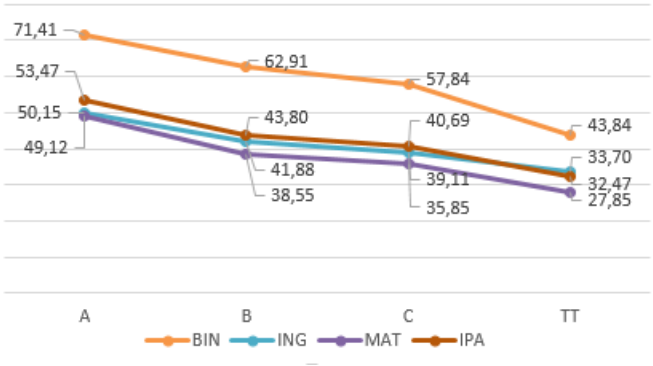

Figure 4: The average UNBK based on accreditation status

Figure 4 shows the average UNBK based on accreditation status. Schools that are A accredited get the highest average UNBK in all fields of study. The

figure also shows the smaller the average UNBK, the lower the level of accreditation status. In this case, there is a close relationship between the accreditation status and UNBK value.

B. Evaluation of Measurement Models

This study uses two forms of measurement models namely reflective models and formative models. Evaluation of reflective measurement models for academic achievement (PA) latent variables obtained that the value of loading factor for each indicator> 0.70 and significant at 5% significance level. So it can be said that the academic achievement has good convergent validity. Meanwhile, evaluation of the measurement model with formative indicator variables is done by looking at the significance of weight. If the significance of weight of *t* test > 1.96 is obtained, it can be said that the indicator is valid. Indicator variables that is not significant can be removed from the next analysis.

There are 11 indicator variables with significance weight of *t* test < 1.96. The Indicators are items 17, 39, 51, 55, 57, 59, 73, 75, 76, 80 and 108. So that the indicators that were not significant were removed from the model. These poor indicator variables can be used as evaluation by interested parties.

In addition, multicollinearity testing for formative indicators needs to be done by calculating the VIF value. The recommended VIF value is VIF <10 to indicate no multicollinearity between independent variabels. The results of each indicator multicollinearity test of the latent variables in model give VIF value < 10 so that all indicators have met the assumption of multicollinearity.

C. Evaluation of Structural Model

The structural model is evaluated by looking at the significance value of each parameter coefficient. The parameter significance value is obtained from the bootstrapping by dividing the parameter coefficient with its standard error value.

In model, the relationship between SI and PA with a path coefficient of 0.018 and a significance value of 0.42 is not statistically significant. This shows that latent variables SI and PA have a relationship in the amount of 0.012 but have not significant on 5% significant level. The structural model obtained and the R-square value and the path coefficient are shown in Figure 5.

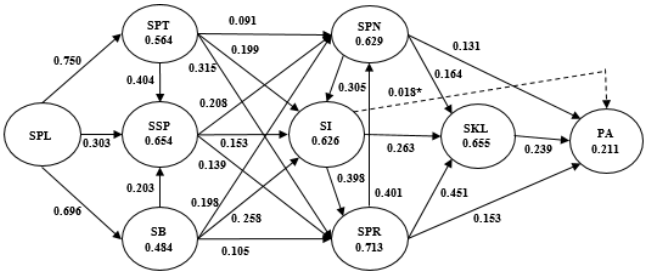

Figure 5: Structural Model

The largest path coefficient is shown by the relationship between SPL and SPT latent variables. The obtained coefficient value is 0.750. This shows that the SPL has a big influence on SPT. In addition SPL has a positive influence on SPT. While the latent variable that has a direct relationship with PA, namely SKL, SI, SPR and SPN, which gives the greatest influence on PA is the SKL in amount of 0.239. The R-square value of each latent variable in model ranged from 0.200 - 0.720. The smallest R-square value is 0.211 in PA. This means that the variant of PA can be explained in the model is 21.1% and the remainder is explained by other unavailable variables in the model.

D. Overall Goodness of Fit

Overall model evaluation can be seen from the FIT and AFIT values. The resulting of FIT value is 0.630. This means that the total variant of all variables that can be explained by the model is 63%. While the adjusted FIT value (AFIT) obtained also shows results that are not much different, namely 62.9%.

IV.CONCLUSION

In this study it can be concluded that the model published by Kemdikbud (2017) is the best model when compared to the other two models, especially in SMP/MTS data in 2017. This model produces 11 invalid indicator variables. National Education Standards that have a significant effect on academic achievement are standard of competency (SKL), standard of process (SPR), and standard of assessment (SPN).

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