



24 tutoring agencies such as reliability, guarantee, and empathy. These results can be used as  
25 material for evaluating the education process in Indonesia.

26 **Keywords:** *Fourier series estimator, Structural Equation Modelling, tutoring agency in Indonesia*

## 27 **Introduction**

28 Indonesia is a developing country in the world that has a problem with its education  
29 system. Generally, Indonesian children feel burdened with the examination system which tends  
30 to be coercive. The curriculum that is provided tends to force students to study harder, especially  
31 near final examinations. Final examination results provide for a large portion of students'  
32 achievement, and facilitate a students' graduation to the next grade. Therefore, students must  
33 study hard outside the school and they must solve many assignments given by teachers in school  
34 which have a high level of difficulty. Tutoring agencies capture these opportunities by giving  
35 students the convenience of study. Statistically, in Indonesia, the number of tutoring agencies  
36 increase every year. One of the examples based on the data in Central Java, in 2009 there are 113  
37 tutoring agencies that have licenses from Directorate of Course and Training Development,  
38 Minister of Education and Culture (Indonesia Bank, 2010). In 2017 there are 162 tutoring  
39 agencies that have a license in Central Java Province (Directorate of Course and Training  
40 Development, 2018). During nine years, there has been a significant growth in the number of  
41 tutoring agencies in Central Java, about 70% growth. Tutoring agencies not only grow—and  
42 develop in town, but also in cities like Semarang and Solo. The data does not include unlicensed  
43 tutoring agencies which number more than licensed agencies.

44 In order to evaluate and give some recommendations, and to predict which students join  
45 with tutoring agency, for the purpose of increasing their academic achievements, knowing their  
46 motivations is very significant. In this paper, nonparametric regression with Fourier series  
47 estimator is used to make a prediction and Structural Equation Modelling (SEM) is used to find  
48 out the significant indicators that affected the students' motivation to join with a tutoring agency.  
49 Nonparametric regression with Fourier series estimator is used to predict the students that join

50 with tutoring agencies because the data is seasonal; when in the period near from final  
51 examination the number of students that join with a tutoring agency will increase, but after final  
52 examination the data will show a decrease. Furthermore, the number of students that join with a  
53 tutoring agency has an increasing trend seasonal data pattern. This data pattern is suitable when  
54 modelled by Fourier series estimator (Mardianto, Kartiko & Utami, 2019)(Tjahjono &  
55 Mardianto, 2018). Besides the use of the Fourier series estimator, SEM is used to determine  
56 indicators that significantly affect the students' motivation to join with a tutoring agency, which  
57 related to latent variables in a questionnaire (Blunch, 2012). Research in an education topic often  
58 involves latent variables. Statistics analysis technique is used to analyse the relationship among  
59 the latent variables as well as between latent variable and its indicators in SEM (Anekawati &  
60 Otok, 2017). Lomax and Schumacker concluded in their research that SEM is often described  
61 using factors that are seen as latent variable (Lomax & Schumacker, 2004). A latent variable  
62 cannot be observed directly but can be observed using measured indicators. In this paper there  
63 are endogenous and some exogenous variables with each indicator that relate to students'  
64 motivation to join a tutoring agency. This paper will contribute to the development of tutoring  
65 agency and educational regulation in Indonesia.

## 66 *Literature Review*

67 In this section, the basic concepts about tutoring agencies in Indonesia, Fourier series  
68 estimator in nonparametric regression for longitudinal data, and SEM are summarized based on  
69 the literature cited or reviewed.

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### 71 *Tutoring Agency in Indonesia*

72 Tutoring agency is an 'outside school' institution that helps students in improving their  
73 knowledge, developing their skills, and bridging those who want to continue to higher education  
74 levels. Under the National Education System Law No. 20 of 2003 which states that courses and  
75 training are forms of continuing education to develop students' abilities with an emphasis on

76 mastering skills, competency standards, and developing professional attitudes. Indonesia  
77 government has recognized tutoring agency that get a license from regional government  
78 (National Education Ministry, 2004).

79 At the beginning of its establishment in the 1970's, tutoring agencies were well-known by third  
80 grade senior high school students who would take the State University entrance examination.  
81 The success of the tutoring agency which led students to enter State Universities is proof that a  
82 tutoring service is one of the successful businesses in the education sector that has prospects in  
83 the future. The emergence of tutoring agencies was also driven by the existence of regulations  
84 related with the entrance examinations to State and Non-Government Universities in Indonesia.  
85 In the 1980's, tutoring agencies received students not only from senior high school, but also  
86 junior high school and elementary school with regular, intensive and private tutorial programs.  
87 Even in recent years, tutoring agencies have offered tutoring program based on multimedia or  
88 online systems. Tutoring agencies compete with each other by offering various types of  
89 interesting learning programs and methods and additional facilities such as outbound, warranty  
90 programs, and motivational seminars (Indonesia Bank, 2010).

91 Thus, it can be seen that at present, the tutoring agency's market opportunities are very  
92 large and promising, so that each tutoring agencies competes with each other by offering various  
93 methods and tutoring programs. The market opportunity for tutoring agencies is also driven by  
94 the government's determination of the national education standards through the increasingly  
95 rigorous National Examination and the selection of state universities which are in high demand.  
96 Until 2017 in Indonesia there were 1362 licensed tutoring agencies, while the number of students  
97 that join a tutoring agency was estimated at about 70.88% of the total number of students in  
98 Indonesia (Directorate of Course and Training Development, 2018).

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100 *Fourier series Estimator in Nonparametric Regression for Longitudinal Data*

101 Regression is a statistical method used to model the relationship between response and  
 102 predictor variables. The regression model is used for making prediction based on a function that  
 103 estimates the data pattern. Based on the data pattern approached by mathematical function, there  
 104 are three approaches in the regression analysis. There are parametric, nonparametric, and semi  
 105 parametric regressions (Budiantara, Ratnasari, Zain, Ratna & Mardianto, 2015). Parametric  
 106 regression is a regression analysis when the data pattern is known or recognized. The most  
 107 popular parametric regression is a linear regression. If the data pattern cannot satisfy assumption  
 108 test, or there are many insignificant parameters, one of the solutions is using nonparametric  
 109 regression as an alternative. Nonparametric regression has a high flexibility in modelling data  
 110 pattern which is unknown or unrecognized, so the regression curve looks for the data pattern  
 111 (Takezawa, 2005). One of estimator used in nonparametric regression is Fourier series that be  
 112 proposed by Bilodeau on 1992 at the first time (Bilodeau, 1992). In this case, the Fourier series  
 113 estimator is applied for longitudinal data. Longitudinal data is the data structure that contains  
 114 elements of cross section and time series data. The advantage of using longitudinal data, can to  
 115 find out the changes that occur in subjects, because the observations are repeated for each  
 116 subject (Wu & Zhang, 2006).

117 Consider pairs of data with form  $(z_{ij}, t_{ij})$ ,  $t_{ij}$  denotes predictor variable for  $j^{th}$   
 118 observation in  $i^{th}$  subject. Here,  $i = 1, 2, \dots, n$  denote the number of subjects,  $j = 1, 2, \dots, n_i$   
 119 denote the number of observations for each subject, and  $p$  represents the number of predictors.  
 120 Response variable for  $j^{th}$  observation in  $i^{th}$  subject is denoted by  $z_{ij}$ . The pairs of data  
 121 presented in Table 1 as follows nonparametric regression equation for longitudinal data

$$z_{ij} = g(t_{ij}) + \varepsilon_{ij}, \varepsilon_{ij} \sim N(0, \sigma^2) \quad (1)$$

122  $z(t_{ij})$  Represents a regression curve. Random error for  $j^{th}$  observation in  $i^{th}$  subject is denoted  
 123 by  $\varepsilon_{ij}$  that independent, identically normal distributed with mean 0, and variance  $\sigma^2$ . In this case,

124 Equation (1) can be approached by Fourier series estimator. The Fourier series equation for  
 125 paired data with form  $(z_{ij}, t_{ij})$  is given in equation (2) as follows:

$$g(t_{ij}) = \frac{\alpha_{0i}}{2} + \gamma_i t_{ij} + \sum_{k=1}^K (\alpha_{ki} \cos kt_{ij} + \beta_{ki} \sin kt_{ij}) \quad (2)$$

126  $k$  is representation of oscillation parameter,  $K$  is the number of oscillation parameter. Parameters  
 127 that their values can be determined based on WLS result (Tjahjono & Mardianto, 2018), denoted  
 128 by  $\alpha_{0i}$ ,  $\gamma_i$ ,  $\alpha_{ki}$  and  $\beta_{ki}$ . The nonparametric regression equation based on Fourier series estimator  
 129 for longitudinal data can be formed with substitution process from equation (2) to equation (1)  
 130 with result as follows:

$$z_{ij} = \frac{\alpha_{0i}}{2} + \gamma_i t_{ij} + \sum_{k=1}^K (\alpha_{ki} \cos kt_{ij} + \beta_{ki} \sin kt_{ij}) + \varepsilon_{ij}, \varepsilon_{ij} \sim N(0, \sigma^2) \quad (3)$$

131 Form equation (3) and based on WLS result, the estimation form for nonparametric regression  
 132 curve can be obtained as follows:

$$\hat{z}_{ij} = \frac{\hat{\alpha}_{0i}}{2} + \hat{\gamma}_i t_{ij} + \sum_{k=1}^K (\hat{\alpha}_{ki} \cos kt_{ij} + \hat{\beta}_{ki} \sin kt_{ij}) \quad (4)$$

133 In this case, three kinds of performance indicators which relate with goodness of fit that popular  
 134 in nonparametric regression study are used to select good model for prediction. There are  
 135 Generalized Cross Validation (GCV), Mean Square Error (MSE), and determination coefficient  
 136 ( $R^2$ ). The first performance indicator that is considered is GCV. Theoretically, the GCV method  
 137 has optimal asymptotic properties which is not owned by other methods such as Cross  
 138 Validation (Wahba, 1990). For determining an optimal quantity measure for smoothing can be  
 139 seen based on the smallest GCV value (Eubank, 1999). The smallest GCV implies the small  
 140 MSE value. The last performance indicator considered is  $R^2$ . In this case, we consider to select  
 141 model with the bigger value of determination coefficient based on parsimony model.

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145 Structural Equation Modelling (SEM), is one of the statistical approaches used for  
146 research with variables that cannot be measured directly, or latent variable, but it is conducted  
147 through indicators as manifest (Ruliana, Budiantara, Otok & Wibowo, 2017). In SEM terms,  
148 generally, “y” contains the endogenous variables and “x” contains the exogenous variables. An  
149 endogenous variable is one that appears at least once as the dependent variable in an equation.  
150 On the other hand, variables that do not appear on the left hand side are exogenous. In other  
151 words, all variances of, and covariance between, exogenous variables are determined outside of  
152 the system. The variances and covariance of the endogenous variables are being modelled as a  
153 function of the exogenous variables (Byrne, 2010). SEM can be stated as combination between  
154 path analysis, factor analysis, and regression. Mathematically, there are many literatures that have  
155 developed about SEM formulation like Bollen (Bollen, 2014), Mc Quitty (Mc Quitty & Wolf,  
156 2013), and other references. In SEM, there are some assumptions that be satisfied like  
157 multivariate normality, non outlier, and non multicollinearity. A relationship between a manifest  
158 variable to latent variable, an indicator to variable, and exogenous variable to endogenous  
159 variable can be decided significant, when in hypothesis test reject null hypothesis ( $H_0$ ) at  
160 significance level  $\alpha$ . Moreover, the reliability measure based on critical ratio needs to be  
161 considered (Mc Quitty & Wolf, 2013). The good SEM is achieved when satisfies three kinds  
162 goodness of fit criterion as general. There is chi square, significance value, Cmin/df, Root Mean  
163 Square Error of Approximation (RMSEA) and Goodness of Fit Index (GFI) for absolute fit  
164 measures criterion. There is Adjusted Goodness of Fit Index (AGFI), and Tucker Lewis Index  
165 (TLI) for incremental fit measures criterion. There is Parsimonious Normal Fit Index (PNFI) for  
166 parsimonious fit measures (Byrne, 2010).

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## 171 **Materials and Method**

### 172 *Data and Variables*

173         There are two data sets taken separately in three of big tutoring agencies in Yogyakarta,  
174 one of cultural and student cities in Indonesia that become the historical place of establishment  
175 the big tutoring agency in Indonesia like Primagama, Neutron, and SSC. The first data set is  
176 secondary data which can be seen in Table 1. The secondary data is monthly data which is taken  
177 over five years. The data is the number of students that join with three tutoring agencies in  
178 Yogyakarta and Central Java Province. A student used three tutoring agencies. The secondary  
179 data is divided into two. They are training and testing data. Training data is used to estimation  
180 process, and out sample data is used to make a prediction. The data for 2014 to 2017 is training  
181 data, while the data for 2018 is testing data. The first data set was analysed based on Fourier  
182 series estimator for longitudinal data. The response variable in this analysis is the proportion of  
183 the students who use three tutoring agencies and the predictor variable is period.

184         The second data set is primary data based on the questionnaire delivered through an  
185 online survey to students who joined a tutoring agency. The population for primary data is the  
186 number students in Indonesia and the sample is the students who used a tutoring agency as the  
187 respondents in the survey amount to 400 students. The sampling technique used is convenience  
188 sampling. Convenience sampling is a non-probability sampling that is efficient for a short survey  
189 period with more effort, less than a half month, and for an unknown population (Thompson,  
190 2012). The list of questions related to the list of variables for SEM is presented in Table 2. The  
191 endogenous variable used is motivation with latent variables facilities, reliability, responsiveness,  
192 guarantee, and empathy as exogenous.

193         Figure 3 presents a path diagram for SEM with variables list based on Table 2. Based on  
194 Table 3, there is one endogenous variable and five exogenous variables. Both of the endogenous  
195 and exogenous variables consist of five manifests.

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## **Result and Discussion**

In this section the result related to descriptive Statistics, build Fourier series estimator in nonparametric regression for longitudinal data based on in sample data until prediction in the proportion to the students use tutoring agencies based on the out sample of the data and the motivation factors of the students to join a tutoring agency based on SEM are discussed into three sub sections.

### ***Descriptive Statistics***

The tutoring agency growth in Indonesia follows the number of students that join tutoring agencies. This is proven by secondary data that had been collected. The data taken for five years in proportion to the students that joined with three tutoring agencies presented the fact that there was an increasing and seasonal trend in each year. When the final examinations are coming, the number of students that join tutoring agencies is increasing until it reaches a peak value, but after that it decreases simultaneously and the pattern would increase in a certain period. However, the decline is not too sharp, because students' interest to join tutoring agencies is growing significantly. Figure 4 is time series plot between the period and proportion of the students that join with three tutoring agencies. There are three tutoring agencies taken as the sample. Based on Figure 4 for the bottom, middle, and top line there are similarities in the trend of seasonal patterns from three tutoring agencies. Those patterns are suitable when they are modelled by Fourier series estimator in nonparametric regression for longitudinal data. The similarities of pattern can be presented in correlation value for each response variables as stated in Table 5. Generally, correlation value is greater than 0.9 indicates that there is a strong correlation. It means that when the number of students who use a tutoring agency growth, it will

222 be followed by the growth of the number of students that join a tutoring agency in other  
223 tutoring agencies. This phenomenon is normally happened when the final examinations are  
224 getting closer in Indonesia.

225 Tutoring agency business will grow because most of the students are satisfied with the  
226 service. Figure 6 is general assessment from 400 students that join tutoring agency. There are six  
227 general assessments that represent latent variables based on questionnaire. For each latent  
228 variable, there are four satisfaction categories, not good, good, very good, and excellent in  
229 services. Most of the students feel that tutoring agency has already given a very good quality in  
230 facility, reliability, responsiveness, and guarantee, empathy, and motivation aspects. Even only a  
231 small number of students feel the quality of tutoring agencies is not good. However, these results  
232 could not be used to determine the significant factors that affect the students joining tutoring  
233 agencies. Therefore, SEM is needed to determine the significant motivation factors of students  
234 to join a tutoring agency specifically.

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### 237 ***Predicting Result***

238 Fourier series estimator is used to predict proportion the students who use with three  
239 tutoring agencies in certain periods simultaneously. The 48 periods were analysed to get the  
240 sample of the data. The periods were conducted from January 2014 until December 2017. Table  
241 7 presents the GCV value for oscillation parameter inputs. Based on Table 7, for the smallest  
242 oscillation parameter value, produce small value of MSE equals to 0.00775, with GCV value  
243 equals to 12964.668. By considering parsimony model, Fourier series estimator with  $k = 1$  can  
244 be selected. The other reason is, based on Table 7, the impairment of MSE is not too far, and  
245 there is no significant decline in the value of GCV. For  $k = 1$ , produced the big value of  $R^2$   
246 equals to 99.6753%. So, the reason to select estimator based on parsimony model is reasonable.  
247 By selecting parsimony model make it easier in computation complexity and application. The

248 estimator form for selected model can be stated into equation (5) with general form is accorded  
249 with equation (4).

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$$\begin{aligned}\hat{z}_{1j} &= 29.5177 + 0.0259 t_{1j} + 0.0034 \cos t_{1j} - 0.0046 \sin t_{1j} \\ \hat{z}_{2j} &= 27.8493 + 0.0222 t_{2j} + 0.0177 \cos t_{2j} - 0.0211 \sin t_{2j} \\ \hat{z}_{3j} &= 30.6725 + 0.0272 t_{3j} + 0.0075 \cos t_{3j} - 0.0212 \sin t_{3j}\end{aligned}\tag{5}$$

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252 Using out sample data, the selected Fourier series estimator is used to predict proportion  
253 the students who used with three tutoring agencies in certain periods simultaneously. There are  
254 12 periods for out sample data. The first period was conducted in January 2018 and the last  
255 period in December 2018. Figure 8 presents the comparison between out sample data and  
256 prediction data.

257 Prediction data is obtained by substituting sequential time to equation (5) for each  
258 response. The solid line in Figure 8 is out sample data, and the dash line is prediction data. Based  
259 on Figure 8 for bottom, middle, and top solid and dash lines, there are similarities in trend  
260 seasonal patterns from three tutoring agencies taken based on real data and prediction result.  
261 Out sample data with prediction data is not much different. The prediction results are logic, as  
262 example the decline in 4<sup>th</sup> period or April is happened because in Indonesia, national  
263 examination, and State University entrance examination is held in April. In Figure 8, there is a  
264 clear increasing trend pattern in the proportion of students who join with three tutoring agencies.  
265 The prediction result has the small MSE value equals to 0.0069 and Mean Absolute Percentage  
266 Error (MAPE) (Bloomfield, 2000), equals to 3.4935%. So, the prediction can be done for future  
267 periods.

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269 ***Motivation Analysis Result***

270 Structural Equation Modelling (SEM) is used to determine significant motivation factors  
271 of students to join a tutoring agency specifically. The variables list used in SEM have been  
272 presented in Table 2 and the path diagram for SEM has been presented in Figure 3. Before SEM  
273 analysis, determining Critical Ratio (CR) can be done for investigating the reliability of data. The  
274 data is reliable when the CR value is greater than 0.6 (Blunch, 2012). Based on the critical ratio  
275 result presented in Table 9, all of critical values for each latent variable is greater than 0.6. So, it  
276 means that manifest variables can explain its latent variable. Therefore, questions in  
277 questionnaire are reliable and could be further analysed by SEM.

278 The significance test for each relationship based on SEM has been presented in Table 10  
279 with general hypotheses as follows:

280  $H_0$ : There is no impact from the manifest variables to the latent variable.

281  $H_1$ : There is impact from the manifest variables to the latent variable.

282 With significance level  $\alpha = 0.1$  (10%),  $H_0$  is rejected when  $p$  value  $< \alpha$ .

283 The rows that are not underlined in Table 10 are the significance result for relationship  
284 between manifest variables with latent variable. Based on Table 10, all of relationship between  
285 manifest variables with latent variable for reliability, guarantee, empathy, and motivation  
286 dimensions are significant. The result is supported by the relationship between exogenous  
287 variables with endogenous variable with hypotheses as follows:

288  $H_0$ : There is no impact from the exogenous variables to the endogenous variable.

289  $H_1$ : There is impact from the exogenous variables to the endogenous variable.

290 It uses significance level  $\alpha = 0.1$  (10%),  $H_0$  is rejected when  $p$  value  $< \alpha$ .

291 The rows underlined in Table 10 are the significance result for relationship between  
292 exogenous and endogenous variable. Based on Table 10, the relationship between reliability,  
293 guarantee, and empathy with motivations are significant. So, reliability, guarantee, and empathy  
294 are significant motivation factors for students to join a tutoring agency. The SEM results have

295 fulfilled goodness of fit criterion related to absolute, incremental, and parsimonious fit measures  
296 criterion. The goodness of fit results and the cut off are presented in Table 11.

297 Therefore, by looking back at the variables list in Table 2, the reliability dimension that  
298 includes service is in accordance with the advertising, material deepening, exercise, time, and  
299 cost, which can grow students' motivation to join tutoring agency. For example, material  
300 deepening and exercises obtained by students in tutoring agency was more intensive as well as  
301 the time and teachers were more flexible than at school. The guarantee dimension that includes  
302 trust to achieve success, competent and a certified tutor, successful alumni experience,  
303 motivation building, and increased academic achievement can grow students' motivation to join  
304 tutoring agency. Generally, students need trust to achieve success, a story about successful  
305 alumni experience, and motivation building in tutoring agency is greater than in school. Empathy  
306 dimension which include a tutors' patience, friendliness, attention, appearance, and attitude can  
307 grow students' motivation to join a tutoring agency. The important thing is the communication  
308 between students with teacher in schools and the tutor of the tutoring agency. The students tend  
309 to be more communicative with the tutor than with teachers in schools. This should be  
310 addressed because the centre of education is the school while the tutoring agency is the  
311 supportive education. The school can change rigid education process and become more flexible  
312 and friendly. Moreover, the government can change the rigid education system and curriculum to  
313 become more flexible and friendly and accommodate students' interests. The tutoring agency  
314 gives a tutor to students based on targets, only the students that have bad scores in school and  
315 difficulties in receiving knowledge are given help in school. So, tutoring agencies become more  
316 intensive for giving help to students' through additional learning outside the school.

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### 318 **Conclusion**

319 The number of students who joined a tutoring agency in Indonesia had an increasing  
320 trend. The prediction results based on the Fourier series estimator for longitudinal data

321 supported this statement. The prediction was accurate since it was done based on the selected  
322 model with goodness of fit that was in line with the criteria. Fourier series estimator for  
323 longitudinal data used for prediction is parsimony model with small MSE value equal to 0.00775  
324 and a big  $R^2$  value equal to 99.6753%. Furthermore, MSE value for prediction is equal to 0.0069  
325 with small MAPE value equal to 3.4035%. Prediction of increasing the proportion of students  
326 who used tutoring agencies is an opportunity for the tutoring agency business competition in  
327 order to improve the quality of learning and develop the business by expanding the area of  
328 operation. One of the ways to improve the quality is by taking regard of the students' motivation  
329 to join a tutoring agency. The motivational factors of students to join a tutoring agency were the  
330 reliability, guarantee, and empathy of the agency. These latent variables and their indicators were  
331 significant in affecting students' motivation to join a tutoring agency based on the SEM analysis  
332 of the results. The SEM had already fulfilled the goodness of fit criteria. The results of SEM  
333 corresponded with the real condition in Indonesia. Generally, the school could not ensure  
334 students achievements in the next grade. The teachers, curriculum and learning methods in the  
335 school were less friendly than in the tutoring agency. In addition, the teacher's treatment towards  
336 students and the school regulations were less reliable than in the tutoring agencies. Therefore,  
337 policy makers in education need to evaluate the education process and systems in Indonesia  
338 without any harm from any parties for better education achievements in the future.

339

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342 publication, three of the certified tutoring agencies in Yogyakarta for the valuable opportunities  
343 during the data collection and the students who were respondents in filling out the questionnaire  
344 forms.

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352 **Appendix**

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**Table 1.** The structure of longitudinal data for this study

Subject	Response ( $z_{ij}$ )	Predictor ( $t_{ij}$ )
1 <sup>st</sup> Subject	$z_{11}$	$t_{11}$
	$z_{12}$	$t_{12}$
	$\vdots$	$\vdots$
	$z_{1n_1}$	$t_{1n_1}$
2 <sup>nd</sup> Subject	$z_{21}$	$t_{21}$
	$z_{22}$	$t_{22}$
	$\vdots$	$\vdots$
	$z_{2n_2}$	$t_{2n_2}$
$\vdots$	$\vdots$	$\vdots$
n <sup>th</sup> Subject	$z_{n1}$	$t_{n1}$
	$z_{n2}$	$t_{n2}$
	$\vdots$	$\vdots$
	$z_{nn_n}$	$t_{nn_n}$

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**Table 2.** The list of variables for SEM

<b>Indicator</b>	<b>Symbol</b>	<b>Variable Types</b>
<b>Facilities</b>	X1	Latent
Classroom	X11	Manifest
Location	X12	Manifest
Supporting facilities	X13	Manifest
Learning material	X14	Manifest
Neat clothes and uniform	X15	Manifest
<b>Reliability</b>	X2	Latent
Service is accordance with the advertising	X21	Manifest
Material deepening	X22	Manifest
Exercise	X23	Manifest
Time	X24	Manifest
Cost	X25	Manifest
<b>Responsiveness</b>	X3	Latent
Special assistance	X31	Manifest
Clarity of material delivery	X32	Manifest
Compatibility of material with school	X33	Manifest
Class mastery	X34	Manifest

Ease of administration	X35	Manifest
<b>Guarantee</b>	X4	Latent
Trust to achieve success	X41	Manifest
Competent and certified tutor	X42	Manifest
Successful alumni experience	X43	Manifest
Motivation building	X44	Manifest
Increased academic achievement	X45	Manifest
<b>Empathy</b>	X5	Latent
Tutor's patient	X51	Manifest
Tutor's friendliness	X52	Manifest
Tutor's attention	X53	Manifest
Tutor's appearance	X54	Manifest
Tutor's attitude	X55	Manifest
<b>Motivation</b>	Y	Latent
Students are more motivated to learn when taking tutoring	Y1	Manifest
Students are more satisfied doing homework and exercises with the tutoring agency	Y2	Manifest
Students are more confidence in having good academic achievements with tutoring agency	Y3	Manifest
Students are more satisfied to ask questions with tutor in tutoring agency than teachers at school.	Y4	Manifest
Students are more understand the material that be delivered by tutor in tutoring agency than teachers at school.	Y5	Manifest

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**Table 5.** Correlation value for each subject

<b>Correlation</b>	<b>Value</b>
correlation ( $z_1, z_2$ )	0.9748
correlation ( $z_1, z_3$ )	0.9878
correlation ( $z_2, z_3$ )	0.9822

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**Table 7.** The MSE and GCV value for each oscillation parameter that be inputted

<b>k</b>	<b>MSE</b>	<b>GCV</b>
1	0.00775	12964.668
2	0.00771	11743.840
3	0.00764	10554.556
4	0.00761	9494.891
5	0.00754	8335.004

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**Table 9.** Critical ratio for each latent variable

<b>Latent Variable</b>	<b>Critical Ratio</b>	<b>Evaluation</b>
Y	0.810	Appropriate

X1	0.657	Appropriate
X2	0.788	Appropriate
X3	0.725	Appropriate
X4	0.773	Appropriate
X5	0.757	Appropriate

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**Table 10.** Significance test for each relationship

Relationship	P – Value	Significance	Relationship	P – Value	Significance
Y ← X1	0.157	Not Significant	X3 ← X34	0.128	Not Significant
Y ← X2	0.056	Significant	X3 ← X35	0.125	Not Significant
Y ← X3	0.127	Not Significant	X4 ← X41	0.087	Significant
Y ← X4	0.087	Significant	X4 ← X42	0.081	Significant
Y ← X5	0.096	Significant	X4 ← X43	0.088	Significant
X1 ← X11	0.063	Significant	X4 ← X44	0.060	Significant
X1 ← X12	0.151	Not Significant	X4 ← X45	0.095	Significant
X1 ← X13	0.154	Not Significant	X5 ← X51	0.085	Significant
X1 ← X14	0.069	Significant	X5 ← X52	0.087	Significant
X1 ← X15	0.145	Not Significant	X5 ← X53	0.098	Significant
X2 ← X21	0.050	Significant	X5 ← X54	0.096	Significant
X2 ← X22	0.050	Significant	X5 ← X55	0.093	Significant
X2 ← X23	0.052	Significant	Y ← Y1	0.093	Significant
X2 ← X24	0.060	Significant	Y ← Y2	0.086	Significant

X2 ← X25	0.055	Significant	Y ← Y3	0.090	Significant
X3 ← X31	0.095	Significant	Y ← Y4	0.090	Significant
X3 ← X32	0.087	Significant	Y ← Y5	0.085	Significant
X3 ← X33	0.122	Not Significant			

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**Table 11.** Goodness of fit criterion

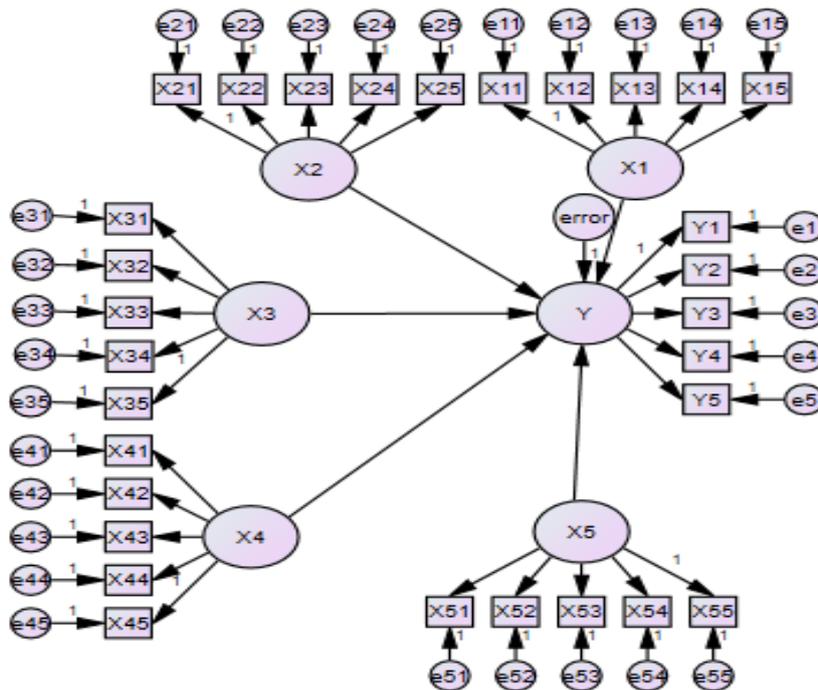
Criterion	Results	Cut off	Evaluation
Multivariate normality	2.533	Between -2.58 until 2.58	Appropriate
$\chi^2$	131.336	$\leq \chi^2$ table = 447.633	Appropriate
Probability	0.070	$\geq 0.05$	Appropriate
Cmin/df	1.877	$\leq 2.00$	Appropriate
RMSEA	0.060	$\leq 0.08$	Appropriate
GFI	0.930	$\geq 0.90$	Appropriate
AGFI	0.923	$\geq 0.90$	Appropriate
TLI	0.937	$\geq 0.90$	Appropriate
PNFI	0.945	$\geq 0.90$	Appropriate

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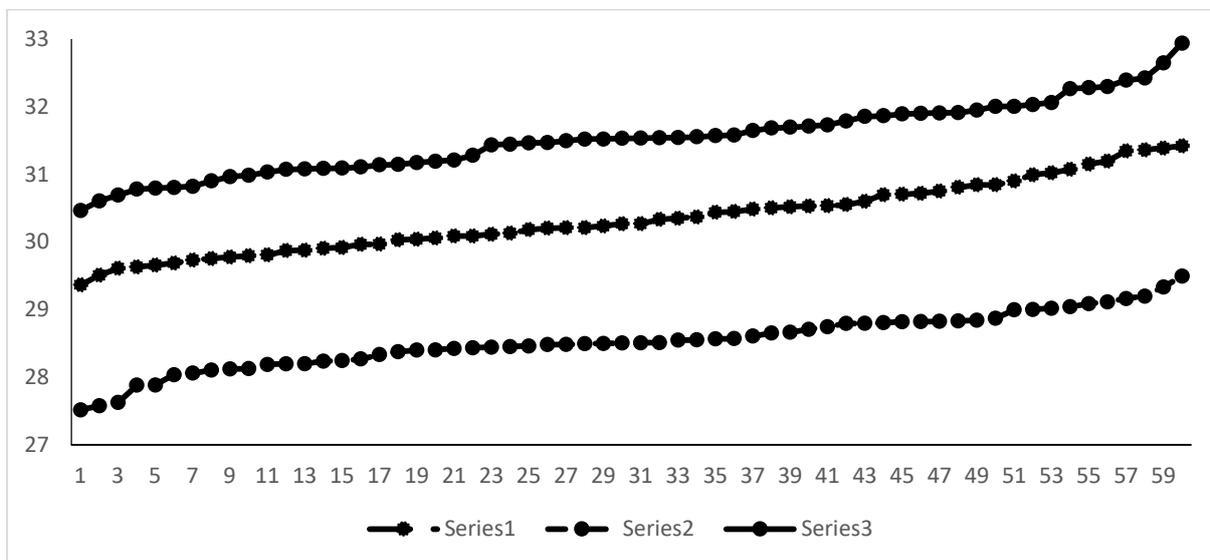


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Figure 3. Path diagram for SEM

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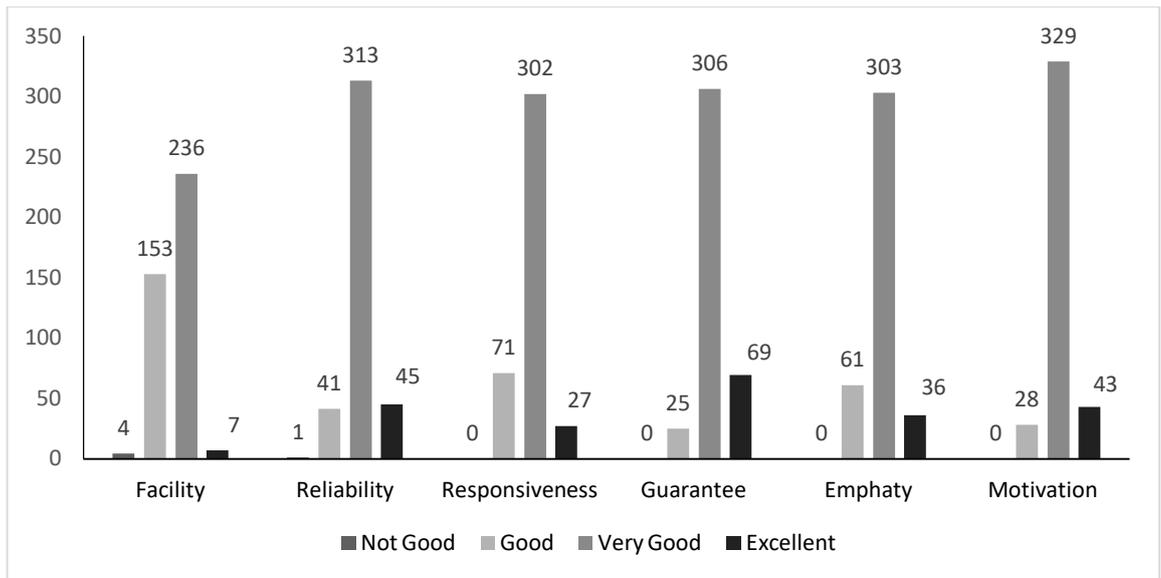
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Figure 4. Time series plot for each subject

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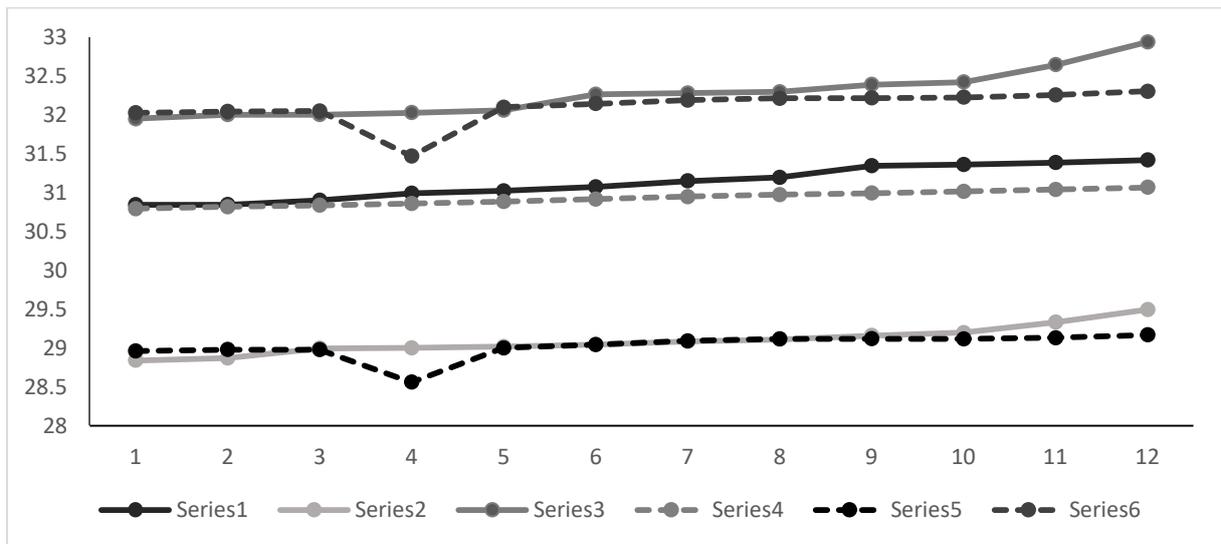
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**Figure 6.** Assessment of respondents for each latent variable

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**Figure 8.** Comparison between out sample data and prediction data

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