

Impact of Self-Leadership on Student Critical Thinking

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This study aims at offering a model to improve student critical thinking through self-leadership at elementary schools in South Jakarta in Indonesia. This model presents that critical thinking can be developed by analysis of cognitive skills, interpretation, inference, evaluation, and monitoring. However, the correlation between explanation and critical thinking is not supported in this study. Student self-leadership is predicted by self-monitoring, goal setting, self-rewarding, self-punishment, clues strategies, intrinsic rewards, rewards after successful activity completion, focusing on attracting task features, desiring successful performance, self-talking, and assessing own thoughts and ideas. Data were collected from 205 students at Grade V from Guntur 01, 03, 08, and 09 public elementary schools in South Jakarta in Indonesia. Analytical data applied the Structural Equation Modelling (SEM). The results showed that there is a positive correlation between student critical thinking and its five dimensions, specifically, analysis of cognitive skills, interpretation, inference, evaluation, and monitoring. However, the association of explanation with critical thinking is not supported in this study. Findings also confirmed that self-monitoring, goal setting, self-rewarding, self-punishment, clues strategies, intrinsic rewards, rewards after successful activity completion, focusing on attracting task features, desiring successful performance, self-talking, and assessing own thoughts and ideas are positively related to student self-leadership.

Key words: *Critical thinking, Self-leadership, Analysis of cognitive skills, Self-monitoring, Self-rewarding.*

Introduction

Martincova and Lukesova (2015), Simpson and Courtney (2007), Boa, Wattanatorn, and Tagong (2018), and Salleh, Tasir, and Shukor (2012) found that interpretation, analysis, evaluation, inference, explanation, and self-regulation encourage critical thinking. In

addition, Ay, Karakaya, and Yilmaz (2015), Sesen and Tabak (2017), Alves et al. (2006), and Kyguoliene and Ganusauskaite (2017) found that behaviour-focused strategies, natural reward strategies, and developing constructive thinking patterns as self-leadership dimensions can create positive ways of thinking. A research done by Ay, Karakaya, and Yilmaz (2015) stated that self-leadership dimensions influence critical thinking. However, there are only a few explanations about measurements of self-leadership and critical thinking dimensions.

The data of the Indonesian Ministry of Education and Culture on 10 May 2018 show that there are 148,856 elementary schools, 1,480,710 teachers, 25,395,436 students, 117,314 educational staff, and 1,114,408 learning groups in Indonesia. There are 1,537 state and 914 private elementary schools, 10,747 male and 27,903 female teachers, 420,539 male and 392,327 female students, 2,130 male and 1,536 female educational staff, and 29,116 learning groups in Jakarta. There are 176 state and 197 private elementary schools in the north Jakarta region, 352 state and 179 private elementary schools in the south Jakarta region, 445 state and 197 private elementary schools in the east Jakarta region, 360 state and 241 private elementary schools in the west Jakarta region, and 190 state and 100 private elementary schools in the central Jakarta region (Sultanmurat et al., 2019).

Based on the regulation of Indonesian Minister of Education and Culture Number 20 in 2016, one of the competencies in skill dimensions of elementary school graduates is having skills of thinking and acting critically. In fact, student critical thinking has not been realised optimally at elementary schools in Jakarta. This study was carried out for 205 students at Grade V from Guntur 01, 03, 08, and 09 public elementary schools in South Jakarta in Indonesia (Radhy, 2019).

Literature Review

Key competencies of critical thinking are interpretation, analysis, evaluation, inference, explanation, and self-regulation (Martincova & Lukesova, 2015; Simpson & Courtney, 2007; Boa, Wattanatorn, & Tagong, 2018; Salleh, Tasir, & Shukor, 2012). These studies found that accurately interpreting information, identifying differences and similarities, evaluating the credibility of sources, creating confirmed conclusions, explaining reasons, and opening to new ideas are sub-dimensions of critical thinking. Gedik (2013) and Aktas and Unlu (2013) found that appropriate activities should be carried out to develop student critical thinking skills. Teachers should know the best methods and techniques to be used in class in order to educate their students to think critically. However, there are still a few explanations about the sub-dimensions of critical thinking skills (Abdigapbarova et al., 2016).

Furthermore, Ay, Karakaya, and Yilmaz (2015), Sesen and Tabak (2017), Alves et al. (2006), and Kyguoliene and Ganusauskaite (2017) found that aspects of self-leadership are

behaviour-focused strategies, natural reward strategies, and developing constructive thinking patterns. Behaviour-focused strategies are more based on self-monitoring, goal setting, self-rewarding, self-punishment and clues strategies leading to successful results. Natural reward strategies pay attention to an individual encouraging to improving performance by focusing on pleasing sides of the tasks. Developing constructive thinking patterns considers improving to control and manage mental models. Those three strategies can assist individuals in improving their effectiveness by facilitating behaviour management, shaping perception, building pleasure aspects into activities, and creating positive ways of thinking. However, there are still few detail clarifications about sub-dimensions of self-leadership.

The study conducted by Ay, Karakaya, and Yilmaz (2015) found that self-leadership dimensions affect critical thinking. Natural reward strategies and constructive thought pattern strategies were significantly and positively correlated with critical thinking. The relationship between behaviour-focused strategies and critical thinking was not supported in this study. However, it needs more confirmation about the association between self-leadership dimensions and critical thinking.

Theoretical Framework

This study argues that self-leadership is predictive variable for critical thinking. Analysis of cognitive skills, interpretation, inference, evaluation, explanation, and monitoring of one's self estimate critical thinking (Ay, Karakaya, & Yilmaz, 2015). Self-leadership may be predicted by self-monitoring, goal setting, self-rewarding, self-punishment, clues strategies, intrinsic rewards, rewards after successful activity completion, focusing on attracting task features, desiring successful performance, self-talking, and assessing own thoughts and ideas (Ay, Karakaya, & Yilmaz, 2015; Kyguoliene & Ganusauskaite, 2017). The hypothesised relationship is described in the model shown in figure 1.

Research Design

Survey study with the questionnaires was used to collect data from 205 students at Grade V from Guntur 01, 03, 08, and 09 public elementary schools in South Jakarta in Indonesia. We used self-leadership as an exogenous variable and critical thinking as the endogenous variable in this study (Mozayan et al., 2018).

The researcher implemented content analysis of the literature for critical thinking based on Ay, Karakaya, and Yilmaz (2015) involving six aspects: analysis of cognitive skills, interpretation, inference, evaluation, explanation, and monitoring of one's self, and self-leadership based on Ay, Karakaya, & Yilmaz (2015), which had eleven dimensions: self-monitoring, goal setting, self-rewarding, self-punishment, clues strategies, intrinsic rewards,

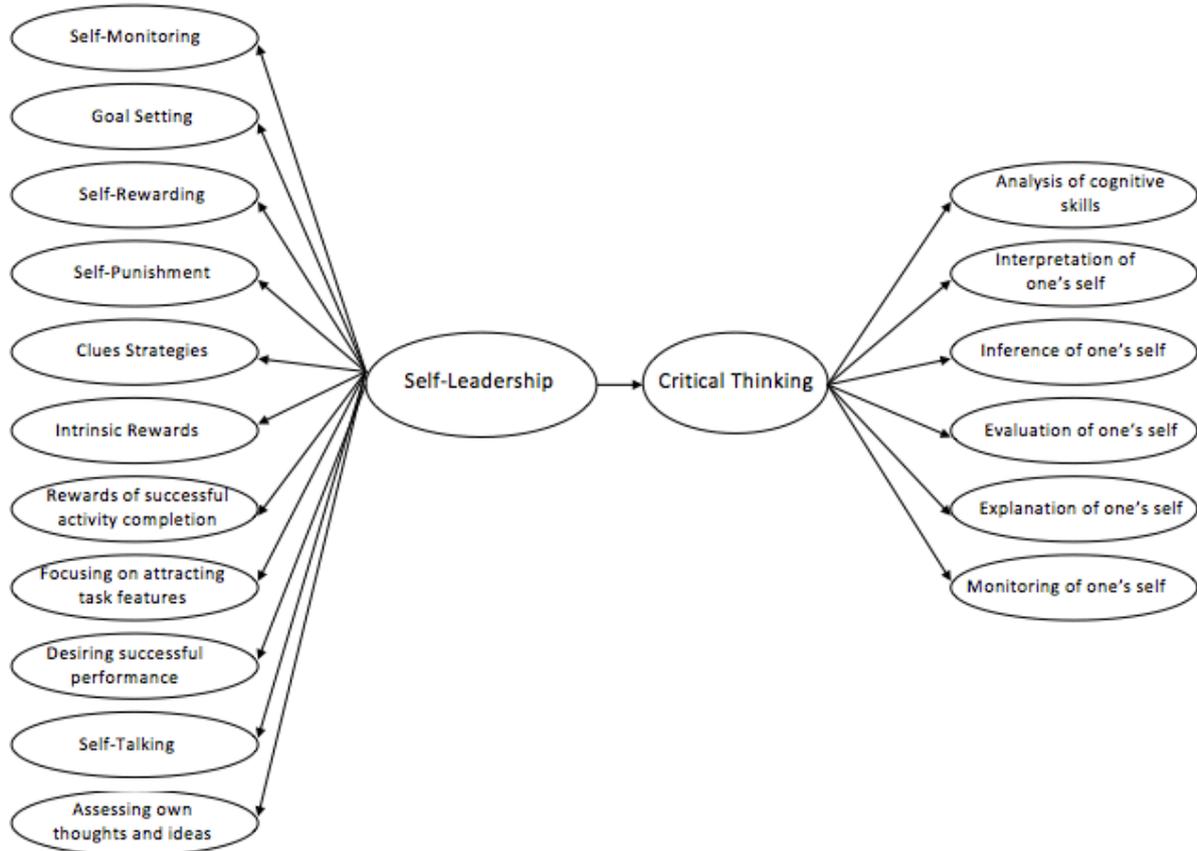
rewards after successful activity completion, focusing on attracting task features, desiring successful performance, self-talking, and assessing own thoughts and ideas. These ideas were converted into the questionnaires delivered to 205 participants.

The questions associated with critical thinking included six dimensions: analysis of cognitive skills, interpretation, inference, evaluation, explanation, and monitoring of one's self. Analysis of cognitive skills consists of three indicators, specifically, exploring ideas, determining arguments, and analysing argument. Interpretation of one's self involves three indicators including understanding the meaning of data series, clarifying the meaning of data series, and expressing the significance of the existing situation. Inference of one's self includes three indicators, specifically, asking something to validate, evaluating argument based on evidence, and drawing an appropriate conclusion). Evaluation of one's self includes three indicators, which are evaluating the credibility of the statement, evaluating arguments, and evaluating logical strength of inferential relationship). Explanation of one's self consists of three indicators: providing clear reasons, proofing, and reporting the results. Monitoring of one's self consists of three indicators: correcting opinion, conducting planned action, and having self-awareness.

The questions involved in self-leadership consist the following eleven dimensions: self-monitoring, goal setting, self-rewarding, self-punishment, clues strategies, intrinsic rewards, rewards after successful activity completion, focusing on attracting task features, desiring successful performance, self-talking, and assessing own thoughts and ideas. Self-monitoring involves three indicators (evaluating attitude done by one's self, trying to improve to be better, and knowing the attitude taken by self-reflection). Goal setting dimension includes three indicators (doing activities to achieve the goal, activities done at present better than before, and activities done leading the goal targeted). Self-rewarding consists of three indicators (providing to reward one's self if succeeding doing something, supporting the effort done, and motivating one's self to do some activities). Self-punishment consists of three indicators (not repeating the same mistakes, giving sanction to one's self if making some mistakes, and trying to do activities to be the best). Clues strategies consist of three indicators (making a list of activities done, maintaining suitable activities done, and correcting existing problems). Intrinsic rewards consist of three indicators (doing fun tasks, doing important tasks to be done, and doing challenging jobs). Rewards after successful activity completion consists of three indicators (feeling satisfied when finishing tasks, having a commitment to completing tasks, and obeying to do the task given). Focusing on attracting task features consists of three indicators (feeling comfortable if completing interesting tasks, focusing on the task done, and prioritising completing tasks rather than doing things that are not important). Desiring successful performance consists of three indicators (doing activities with better results than before, focusing on achieving the goals set, and being able to overcome the existing failure). Self-talking consists of three indicators (speaking negatively

to one's self, communicating with yourself optimistically, and reflecting on the activities done). Assessing own thoughts and ideas consists of three indicators (knowing what is believed, knowing one's assumption about something, and changing belief of one's self).

Figure 1. Theoretical framework of the study



In this research, the Structural Equation Modelling (SEM) was applied for data analysis using IBM SPSS Statistics 24 and SPSS AMOS 24 in 2017 Edition. It was implemented to investigate the set of associations between self-leadership as the exogenous variable and critical thinking as the endogenous variable. Data was inputted into Excel by entering the scores of each item based on 205 participant responses with scales strongly agree, agree, neutral, disagree, and strongly disagree (scored 5, 4, 3, 2, and 1, respectively, for positive questions and 1, 2, 3, 4, and 5, respectively, for negative questions).

Findings

Table 1 shows the goodness-of-fit statistical analysis results. More specifically, the Normed Fit Index (NFI) value attained 0.533, indicating that the model suggested in this study is a good fit. The Comparative Fit Index (CFI) value achieved 0.719, indicating that the model is

a good fit. The Incremental Fit Index (IFI) value was 0.729, showing that the model is a good fit. The Relative Fit Index (RFI) value gained 0.486, indicating that the model is a good fit. Therefore, SEM measurement showed that the model presented in this research is a fit model.

Table 1: Model Fit Summary

Fit measurement	Fit Value		
	<i>Cut-Off Limitation</i>	<i>Value</i>	<i>Decision</i>
NFI	$0 < \text{NFI} < 1$; $\text{NFI} \geq 0.90 = \text{good fit}$	0.533	Good Fit
CFI	$0 < \text{CFI} < 1$; $\text{CFI} \geq 0.90 = \text{good fit}$	0.719	Good Fit
IFI	$0 < \text{IFI} < 1$; $\text{IFI} \geq 0.90 = \text{good fit}$	0.729	Good Fit
RFI	$0 < \text{RFI} < 1$; $\text{RFI} \geq 0.90 = \text{good fit}$	0.486	Good Fit

Table 2 offered a measurement model test of observed variables. The coefficients of the relationship between analysis of cognitive skills, interpretation, inference, evaluation, and monitoring and were statistically significant 0.229, 0.338, 0.530, 1.545, and 0.560, respectively. However, the association between explanation and critical thinking was not supported in this study. Exploring ideas was significantly correlated with analysis of cognitive skills of 1.128. However, the correlation between determining arguments and analysing argument as observed variables with analysis of cognitive skills of 0.352 and 0.189 was not supported in this research. Understanding the meaning of data series, clarifying the meaning of data series, and expressing the significance of existing situations as observed variables were significantly associated with interpretation of one's self of 0.871, 0.462, and 0.396, respectively. Asking something to validate and drawing an appropriate conclusion were significantly correlated with inference of one's self of 0.431 and 0.665. However, the connection between evaluating argument based on evidence and inference of one's self of -0.104 was not supported in this research. Evaluating the credibility of statement, evaluating the argument, and evaluating logical strength of the inferential relationship were significantly correlated with evaluation of one's self of 0.359, 0.587, and 0.392, respectively. Providing clear reason, as observed variable was significantly associated with explanation of one's self of 0.201. However, the association between proofing and reporting the results as observed variables and explanation of one's self of 0.507 and 0.260 were not supported in this study. Correcting opinion and having self-awareness, as observed variables were significantly associated with monitoring of one's self of 0.664 and 0.644. However, correlation between conducting planned action, as observed variable and monitoring of one's self of 0.164 was not supported in this research.

As shown in Table 2, self-monitoring, goal setting, self-rewarding, self-punishment, clues strategies, intrinsic rewards, rewards after successful activity completion, focusing on attracting task features, desiring successful performance, self-talking, and assessing own

thoughts and ideas as observed variables were statistically and significantly correlated with self-leadership of 0.985, 1.006, 0.968, 0.978, -1.031, 1.053, 1.004, 1.042, 0.926, 0.882, and 0.979, respectively. Evaluating attitude done by one's self, trying to improve to be better, and knowing the attitude taken by self-reflection as observed variables were significantly associated with self-monitoring of 0.754, 0.816, and 0.818, respectively. Doing activities to achieve the goal, activities done at present better than before, and activities done leading the goal targeted as observed variables were significantly associated with goal setting of 0.706, 0.902, and 0.781, respectively. Providing to reward one's self if succeeding doing something, supporting the effort done, and motivating one's self to do some activities as observed variables were significantly connected with self-rewarding of 0.586, 0.818, and 0.755, respectively. Not repeating same mistakes, giving sanction to one's self if doing some mistakes, and trying to do activities to be the best as observed variables were significantly correlated with self-punishment of -0.274, 0.806, and 0.251, respectively.

Making a list of activities done, maintaining suitable activities done, and correcting existing problems as observed variables were significantly connected with clues strategies of -0.568, -0.729, and 0.190, respectively. Doing fun task, doing important tasks to be done, and doing challenging jobs as observed variables were significantly connected with intrinsic rewards of 0.564, 0.685, and 0.176, respectively. Feeling satisfied when finishing task, having commitment to completing task, and obeying to do the task given as observed variables were significantly connected with rewards after successful activity completion of 0.781, 0.784, and 0.841, respectively. Feeling comfortable if completing interesting tasks, focusing on task done, and prioritising completing tasks rather than doing things that are not important as observed variables were significantly connected with focusing on attracting task features of 0.666, 0.669, and 0.570, respectively. Doing activities with better results than before, focusing on achieving the goals set, and being able to overcome the existing failure as observed variables were significantly associated with desiring successful performance of 0.849, 0.784, and 0.526, respectively. Speaking negatively to one's self and communicating with yourself optimistically, as observed variables were significantly correlated with self-talking of 0.718 and 0.520. However, the association between reflecting on the activities done as observed variable and self-talking of 0.040 was not supported in this research. Knowing what is believed, knowing one's assumption about something, and changing belief of one's self, as observed variables were significantly associated with assessing own thoughts and ideas of 0.632, 0.675, and 0.523, respectively.

The structural model test in Table 2 shows a direct effect of self-leadership on critical thinking with a coefficient of 0.268, which is significant at the 0.05 level. The structural model is presented in Figure 2.

Table 2: Measurement model test
Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
CT	<---	SL	0.046	0.023	2.045	0.041	
SLA	<---	SL	1.000				
SLB	<---	SL	0.981	0.097	10.112	***	
SLC	<---	SL	0.915	0.100	9.187	***	
SLD	<---	SL	0.313	0.115	2.729	0.006	
SLE	<---	SL	-0.275	0.128	-2.152	0.031	
SLF	<---	SL	0.214	0.105	2.045	0.041	
SLG	<---	SL	1.186	0.106	11.230	***	
SLH	<---	SL	0.891	0.126	7.092	***	
SLI	<---	SL	0.683	0.118	5.785	***	
SLJ	<---	SL	0.781	0.148	5.269	***	
SLK	<---	SL	0.737	0.124	5.949	***	
CTA	<---	CT	1.000				
CTB	<---	CT	1,328	0.561	2,369	0.018	
CTC	<---	CT	0.923	0.445	2.074	0.038	
CTD	<---	CT	2.774	1.157	2.398	0.016	
CTE	<---	CT	2.013	1.346	1.496	0.135	
CTF	<---	CT	2.436	0.935	2.605	0.009	
SL3	<---	SLA	1.000				
SL2	<---	SLA	1.118	0.104	10.795	***	
SL1	<---	SLA	1.034	0.107	9.627	***	
SL6	<---	SLB	1.000				
SL5	<---	SLB	1.246	0.106	11.758	***	
SL4	<---	SLB	1.128	0.132	8.550	***	
SL9	<---	SLC	1.000				
SL8	<---	SLC	1.144	0.121	9.481	***	
SL7	<---	SLC	0.742	0.114	6.526	***	
SL12	<---	SLD	1.000				
SL11	<---	SLD	3.537	1.295	2.731	0.006	
SL10	<---	SLD	-1.270	0.617	-2.059	0.040	
SL15	<---	SLE	1.000				
SL14	<---	SLE	-3.855	1.803	-2.138	0.033	
SL13	<---	SLE	-2.617	1.251	-2.093	0.036	
SL18	<---	SLF	1,000				
SL17	<---	SLF	4.565	2.254	2.025	0.043	

			Estimate	S.E.	C.R.	P	Label
SL16	<---	SLF	3.623	1.817	1.995	0.046	
SL21	<---	SLG	1.000				
SL20	<---	SLG	0.851	0.079	10.738	***	
SL19	<---	SLG	0.830	0.078	10.686	***	
SL24	<---	SLH	1.000				
SL23	<---	SLH	1.185	0.189	6.259	***	
SL22	<---	SLH	1.002	0.161	6.243	***	
SL27	<---	SLI	1.000				
SL26	<---	SLI	1.363	0.234	5.818	***	
SL25	<---	SLI	1.487	0.247	6.027	***	
SL30	<---	SLJ	1.000				
SL29	<---	SLJ	1.085	0.215	5.043	***	
SL28	<---	SLJ	0.063	0.154	0.405	0.686	
SL32	<---	SLK	1.131	0.208	5.443	***	
SL31	<---	SLK	1.074	0.205	5.238	***	
CT1	<---	CTA	1.000				
CT2	<---	CTA	,458	,334	1,372	,170	
CT3	<---	CTA	,290	,240	1,212	,225	
CT4	<---	CTB	1.000				
CT5	<---	CTB	0.562	0.190	2.958	0.003	
CT6	<---	CTB	0.476	0.171	2.789	0.005	
CT7	<---	CTC	1.000				
CT8	<---	CTC	-0.205	0.237	-0.865	0.387	
CT9	<---	CTC	1.703	0.646	2.635	0.008	
CT10	<---	CTD	1.000				
CT11	<---	CTD	1.701	0.435	3.913	***	
CT12	<---	CTD	1.180	0.358	3.291	***	
CT13	<---	CTE	1.000				
CT14	<---	CTE	0.974	0.600	1.624	0.104	
CT15	<---	CTE	0.563	0.403	1.397	0.162	
CT16	<---	CTF	1.000				
CT17	<---	CTF	0.101	0.069	1.457	0.145	
CT18	<---	CTF	0.497	0.123	4.042	***	
SL33	<---	SLK	1.000				

Standardised Regression Weights: (Group number 1 - Default model)

			Estimate
CT	<---	SL	0.268
SLA	<---	SL	0.985
SLB	<---	SL	1.006
SLC	<---	SL	0.968
SLD	<---	SL	0.978
SLE	<---	SL	-1.031
SLF	<---	SL	1.053
SLG	<---	SL	1.004
SLH	<---	SL	1.042
SLI	<---	SL	0.926
SLJ	<---	SL	0.882
SLK	<---	SL	0.979
CTA	<---	CT	0.229
CTB	<---	CT	0.338
CTC	<---	CT	0.530
CTD	<---	CT	1.545
CTE	<---	CT	0.693
CTF	<---	CT	0.560
SL3	<---	SLA	0.818
SL2	<---	SLA	0.816
SL1	<---	SLA	0.754
SL6	<---	SLB	0.781
SL5	<---	SLB	0.902
SL4	<---	SLB	0.706
SL9	<---	SLC	0.755
SL8	<---	SLC	0.818
SL7	<---	SLC	0.586
SL12	<---	SLD	0.251
SL11	<---	SLD	0.806
SL10	<---	SLD	-0.274
SL15	<---	SLE	0.190
SL14	<---	SLE	-0.729
SL13	<---	SLE	-0.568
SL18	<---	SLF	0.176
SL17	<---	SLF	0.685
SL16	<---	SLF	0.564

			Estimate
SL21	<---	SLG	0.841
SL20	<---	SLG	0.784
SL19	<---	SLG	0.781
SL24	<---	SLH	0.570
SL23	<---	SLH	0.669
SL22	<---	SLH	0.666
SL27	<---	SLI	0.526
SL26	<---	SLI	0.784
SL25	<---	SLI	0.849
SL30	<---	SLJ	0.520
SL29	<---	SLJ	0.718
SL28	<---	SLJ	0.040
SL32	<---	SLK	0.675
SL31	<---	SLK	0.632
CT1	<---	CTA	1.128
CT2	<---	CTA	0.352
CT3	<---	CTA	0.189
CT4	<---	CTB	0.871
CT5	<---	CTB	0.462
CT6	<---	CTB	0.396
CT7	<---	CTC	0.431
CT8	<---	CTC	-0.104
CT9	<---	CTC	0.665
CT10	<---	CTD	0.359
CT11	<---	CTD	0.587
CT12	<---	CTD	0.392
CT13	<---	CTE	0.201
CT14	<---	CTE	0.507
CT15	<---	CTE	0.260
CT16	<---	CTF	0.664
CT17	<---	CTF	0.164
CT18	<---	CTF	0.644
SL33	<---	SLK	0.523

Notes:

CT = Critical thinking

SL = Self-leadership

SLA = Self-monitoring



- SLB = Goal setting
- SLC = Self-rewarding
- SLD = Self-punishment
- SLE = Clues strategies
- SLF = Intrinsic rewards
- SLG = Rewards after successful activity completion
- SLH = Focusing on attracting task features
- SLI = Desiring successful performance
- SLJ = Self-talking
- SLK = Assessing own thoughts and ideas
- CTA = Analysis of cognitive skills
- CTB = Interpretation of one's self
- CTC = Inference of one's self
- CTD = Evaluation of one's self
- CTE = Explanation of one's self
- CTF = Monitoring of one's self
- SL1 = Evaluating attitude done by one's self
- SL2 = Trying to improve to be better
- SL3 = Knowing the attitude taken by self-reflection
- SL4 = Doing activities to achieve the goal
- SL5 = Activities done at present better than before
- SL6 = Activities done leading the goal targeted
- SL7 = Providing to reward one's self if succeeding doing something
- SL8 = Supporting the effort done
- SL9 = Motivating one's self to do some activities
- SL10 = Not repeating the same mistakes
- SL11 = Giving sanction to one's self if doing some mistakes
- SL12 = Trying to do activities to be the best
- SL13 = Making a list of activities done
- SL14 = Maintaining good activities done
- SL15 = Correcting existing problems
- SL16 = Doing fun tasks
- SL17 = Doing important tasks to be done
- SL18 = Doing challenging jobs
- SL19 = Feeling satisfied when finishing tasks
- SL20 = Having a commitment to completing the task
- SL21 = Obeying to do the task given
- SL22 = Feeling comfortable if completing interesting tasks
- SL23 = Focusing on task done
- SL24 = Prioritising completing the task rather than doing things that are not important

- SL25 = Doing activities with better results than before
- SL26 = Focusing on achieving the goals set
- SL27 = Being able to overcome the existing failure
- SL28 = Speaking negatively to one's self
- SL29 = Communicating with yourself optimistically
- SL30 = Reflecting on the activities done
- SL31 = Knowing what is believed
- SL32 = Knowing one's assumption about something
- SL33 = Changing belief of one's self
- CT1 = Exploring ideas
- CT2 = Determining arguments
- CT3 = Analysing an argument
- CT4 = Understanding the meaning of data series
- CT5 = Clarifying the meaning of data series
- CT6 = Expressing the significance of the existing situation
- CT7 = Asking something to validate
- CT8 = Evaluating argument based on evidence
- CT9 = Drawing appropriate conclusion
- CT10 = Evaluating credibility of the statement
- CT11 = Evaluating argument
- CT12 = Evaluating logical strength of inferential relationship
- CT13 = Providing clear reason
- CT14 = Proofing
- CT15 = Reporting the results
- CT16 = Correcting opinions
- CT17 = Conducting planned actions
- CT18 = Having self-awareness

Discussion

The indicators of the goodness of fit such as NFI, CFI and RFI as shown in table 1 were all greater than 0 and less than 1, indicating that the model is a good fit.

Table 2 exhibits that analysis of cognitive skill, interpretation, inference, evaluation, and monitoring had a significant positive relationship with critical thinking.. However, the association between explanation and critical thinking was not supported in this study. This result is similar to that of Ay, Karakaya, and Yilmaz (2015), Simpson and Courtney (2007), and Salleh, Tasir, and Shukor (2012) claiming that analysis of cognitive skills, interpretation, inference, evaluation, and monitoring predicted critical thinking. In line with the study of Martincova and lukesova (2015), critical thinking is a process of evaluating information.

However, Ay, Karakaya, and Yilmaz (2015) found that explanation was significantly correlated with critical thinking.

Figure 2. The structural model

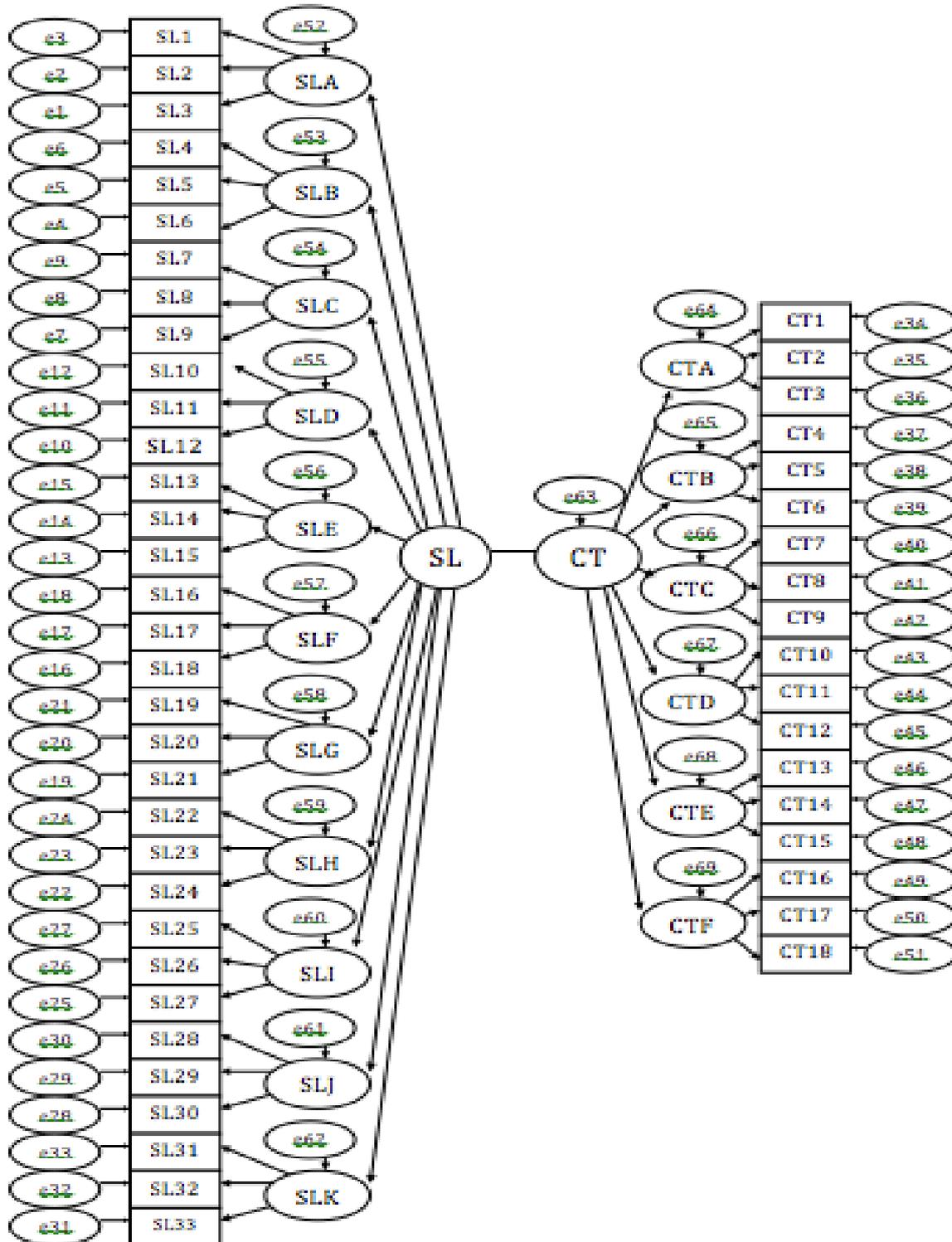


Table 2 presents that exploring ideas had a significant correlation with analysis of cognitive skills. However, the correlation between determining arguments and analysing arguments as observed variables with analysis of cognitive skills was not supported. This result is in line with Martincova and Lukesova's (2015) finding, reporting that exploration of ideas is a crucial competence of critical thinking. However, this result is not similar to the study of Abdi (2012) finding that one of the components of critical thinking skills is analysis-thinking style. In addition to this, Martincova and Lukesova (2015) state that detection and analysis of arguments are key competencies of critical thinking.

Understanding the meaning of data series, clarifying the meaning of data series, and expressing the significance of existing situations as observed variables had significant association with interpretation of one's self. This result is similar to the study of Martincova and Lukesova (2015) presenting that ability to sort information, evaluate the significance of information or clarification of the meaning is one of the key competencies of critical thinking.

In addition, the study showed that asking something to validate and drawing appropriate conclusion as observed variables had significant correlation coefficients with inference of one's self.. However, the connection between evaluating arguments based on evidence and inference of one's self was not supported in this research. This is in line with the study of Aktas and Unlu (2013) stating that induction is one of the components of critical thinking skills. This finding is not in line with the study of Abdi (2012) recognising that evaluation-thinking style is a component of critical thinking skills.

Evaluating credibility of statement, evaluating argument, and evaluating logical strength of inferential relationship as observed variables were significantly correlated with evaluation of one's self. This is consistent with the study of Boa, Wattanatorn, and Tagong (2018) suggesting that recognising assumptions, evaluating arguments, and drawing conclusions are elements of critical thinking. Martincova and Lukesova (2015) found that ability to evaluate the claim and assess arguments, assessing the credibility of statement, and assessing the logical strength of the actual inferential connection between description and questions are the key competencies of critical thinking.

Providing clear reason, as observed variable was significantly associated with explanation of one's self. However, the association between proofing and reporting the results as observed variables with explanation of one's self were not supported in this study. This is similar to the study of Martincova and Lukesova (2015) stating that basic form of critical thinking is based on clarity, accuracy, consistency, relevance, persuasiveness, depth, width, and justice thinking. This differs from Martincova and Lukesova (2015)' findings, stating that

questioning the evidence, making assumptions, and drawing conclusions are key competencies of critical thinking.

Correcting opinions and having self-awareness, as observed variables were significantly associated with monitoring of one's self. However, the correlation between conducting planned action, as observed variable and monitoring of one's self was not supported in this research. This is in line with the study of Martincova and Lukesova (2015) finding that critical thinking is associated with improving previous opinions, ability of examining the views, and review of responses because of errors.

In Table 2, it can be seen that self-monitoring, goal setting, self-rewarding, self-punishment, clues strategies, intrinsic rewards, rewards after successful activity completion, focusing on attracting task features, desiring successful performance, self-talking, and assessing own thoughts and ideas as observed variables had significant association with self-leadership. This is similar to findings of Ay, Karakaya, & Yilmaz (2015), and Kyguoliene and Ganusauskaite (2017) indicating that these variables are the sub-dimensions of self-leadership.

Evaluating attitude done by one's self, trying to improve to be better, and knowing the attitude taken by self-reflection as observed variables were significantly associated with self-monitoring. This result is consistent with Kyguoliene and Ganusauskaite (2017)'s research showing that the students recognising and finding a substitute for ineffective behaviours and negative thought processes with more effective behaviours is a sub-dimension of self-leadership related to self-monitoring.

Doing activities to achieve the goal, activities done at present better than before, and activities done leading the goal targeted as observed variables were significantly associated with goal setting. This finding is similar to the study of Houghton, Dawley, and DiLiello (2012) stating that establishing specific goals for one's own performance and working toward specific goals set for one's self are sub-dimensions of self-leadership related to goal setting.

Providing to reward one's self if succeeding doing something, supporting the effort done, and motivating one's self to do some activities as observed variables were significantly connected with self-rewarding. This is the same as the findings of Ay, Karakaya, and Yilmaz (2015) presenting that individuals rewarding themselves following successful activity completion is a sub-dimension of self-rewarding.

Not repeating same mistakes, giving sanction to one's self if making some mistakes, and trying to do activities to be the best as observed variables were significantly correlated with self-punishment. This is in line with Kyguoliene and Ganusauskaite (2017)'s findings stating

that the students controlling behaviour not making the same mistakes is a sub-dimension of self-leadership related to self-punishment.

Making a list of activities done, maintaining suitable activities done, and correcting existing problems as observed variables were significantly connected with clues strategies. This is similar to the findings of Kyguoliene and Ganusauskaite (2017) stating that student writing notes or using reminders to assist them in focusing on the task needed to be accomplished is a sub-dimension of critical thinking related to self-cueing.

Doing fun tasks, doing important tasks to be done, and doing challenging jobs as observed variables had a significant association with intrinsic rewards. This is similar to the study of Ay, Karakaya, and Yilmaz (2015) finding that individuals focusing on the characteristic of the task attracting them is one of sub-dimensions of intrinsic rewards.

Feeling satisfied when finishing tasks, having a commitment to completing tasks, and obeying to do the task given as observed variables were significantly connected with rewards after successful activity completion. This result is in line with the findings Kyguoliene and Ganusauskaite (2017) stating that the student rewarding with favourite things after completing the task is a sub-dimension of self-leadership.

Feeling comfortable if completing interesting tasks, focusing on tasks done, and prioritising completing tasks rather than doing things that are not important as observed variables were significantly connected with focusing on attracting task features. This is similar to the study of Kyguoliene and Ganusauskaite (2017) stating that students tend to pay attention to enjoyable aspects of tasks is a sub-dimension of self-leadership.

Doing activities with better results than before, focusing on achieving the goals set, and being able to overcome the existing failure as observed variables were significantly associated with desiring successful performance. This finding is in line with the results of the study of Kyguoliene and Ganusauskaite (2017) stating that the students visualising successful performance before involved in a performance intended to perform successfully when faced with the actual ask is a sub-dimension of self-leadership.

Speaking negatively to one's self and communicating with yourself optimistically, as observed variables were significantly correlated with self-talking. However, the association between reflecting on the activities done as observed variable and self-talking was not supported in this research. This result is not similar to Houghton, Dawley, and DiLiello (2012)'s study finding that trying to mentally assess the appropriateness of one's own beliefs is a sub-dimension of self-leadership related to self-talking.

Knowing what is believed, knowing one's assumption about something, and changing belief of one's self, as observed variables had a significant association with assessing own thoughts and ideas. This result is in line with Houghton, Dawley, and DiLiello (2012)'s findings stating that identifying dysfunctional beliefs and assumptions is a sub-dimension of self-leadership related to constructive thought strategies.

A direct effect of self-leadership on critical thinking has the coefficient 0.268, which is significant at the 0.05 level. This result was in line with Ay, Karakaya, and Yilmaz (2015)'s findings stating that the sub-dimension of student self-leadership was related to critical thinking skills.

Conclusion

This study presents an empirical evidence-based model for the improvement of critical thinking. Self-leadership can predict critical thinking. Analysis of cognitive skills, interpretation, inference, evaluation, and monitoring predict critical thinking. However, explanation as a predictor of critical thinking is not supported in this study. Exploring ideas stimulates analysis of cognitive skills. However, determining arguments and analysing argument as predictors of analysis of cognitive skills are not supported in this research. Understanding the meaning of data series, clarifying the meaning of data series, and expressing the significance of existing situations encourage interpretation. Asking something to validate and drawing appropriate conclusions predict the inference. However, evaluating argument based on evidence as a predictor of inference is not supported. Evaluating the credibility of statement, evaluating the argument, and evaluating logical strength of inferential relationship stimulate evaluation. Providing clear reason encourages explanation. However, proofing and reporting the results as predictors of explanation are not supported in this study. Correcting opinion and having self-awareness predict monitoring of one's self. However, conducting planned actions as a predictor of monitoring of one's self is not supported.

Furthermore, self-monitoring, goal setting, self-rewarding, self-punishment, clues strategies, intrinsic rewards, rewards after successful activity completion, focusing on attracting task features, desiring successful performance, self-talking, and assessing own thoughts and ideas affect self-leadership. Evaluating attitude done by one's self, trying to improve to be better, and knowing the attitude taken by self-reflection encourage self-monitoring. Doing activities to achieve the goal, activities done at present better than before, and activities done leading the goal targeted estimate goal setting. Providing to reward one's self if succeeding doing something, supporting the effort done, and motivating one's self to do some activities predict self-rewarding. Not repeating the same mistakes, giving sanction to one's self if making some mistakes, and trying to do activities to be the best stimulate self-punishment. Making a list of activities done, maintaining suitable activities done, and correcting existing problems



encourage clues strategies. Doing fun tasks, doing important tasks to be done, and doing challenging jobs predict intrinsic rewards. Feeling satisfied when finishing tasks, having a commitment to completing tasks, and obeying to do the task given estimate rewards after successful activity completion. Feeling comfortable if completing interesting tasks, focusing on tasks done, and prioritising completing tasks rather than doing things that are not important predict focusing on attracting task features. Doing activities with better results than before, focusing on achieving the goals set, and being able to overcome the existing failure encourage desiring successful performance. Speaking negatively to one's self and communicating with yourself optimistically predict self-talking. However, reflecting on the activities done as a predictor of self-talking is not supported in this research. Knowing what is believed, knowing one's assumption about something, and changing belief of one's self estimate assessing own thoughts and ideas.



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