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Original Paper

Variables of Self-Regulated Learning as Predictors of Academic Achievement

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Abstract

This study examined the four variables of self-regulated learning, namely processing strategies, regulation strategies, mental models of learning, and learning orientations in predicting students' academic achievement. The study constituents included 578 first year students [(Female n=479; 82.9%); Male n=99; 17.1%)] enrolled at Faculty of Psychology, in three universities in three big cities in Indonesia, Medan North Sumatra (n=258; 44.6%), Jakarta the capital city (n=209; 36.2%) and Surabaya East Java (n=111; 19.2%). The range of the participants' age was from 17 to 23 years, and the mean age was 18.99 years. The Indonesia version of Vermunt's Inventory of Learning Styles (ILS) was implemented to measure the four variables of self-regulated learning. The result of this study revealed that the four variables of self-regulated learning were significant predictors of students' academic achievement. The study also showed the differences in the four variables of self-regulated learning in terms of gender and the university.

Keywords

academic achievement, higher education, learning process, metacognition, self-regulation

1. Introduction

Learning quality is used to determine the degree of implementation of learning activities and processes carried out by students and is always linked to achievement (Ghufron & Hardiyanto, 2017; İlçin, Tomruk, Yeşilyaprak, et al., 2018). Ghufron and Hardiyanto (2017) also stated that one of the important indicators that characterizes the quality of learning is the quality of students. According to Lawson and Kirby (in Ali & Masih, 2021) and İlçin, Tomruk, Yeşilyaprak, et al., (2018) one of the factors that influences the quality of learning is the learning process and approaches carried out by the learner along with the resulting knowledge structure which is stored in memory.

Various studies have reported that self-regulation plays important role in learning, for example learning the second language (Khodarahmi & Zarrinabadi, 2016; Alzubaidi, Aldridge & Khine, 2016; Huang, 2022; Wijaya & Setiawan, 2021), mathematical problems (Perels, Dignath & Schmitz, 2009; Labuhn, Zimmerman & Hasselhorn, 2010), science (Li, Zheng, Liang, Zhang & Tsai, 2016), and medical education (Siddaiah-Subramanya, Nyandowe & Zubair, 2017). Thus, self-regulation in learning will influence academic achievement (Schapiro & Livingston, 2000; de Acedo Lizarraga, Ugarte, et al., 2003; Vermunt, 2005; Labuhn, Zimmerman & Hasselhorn, 2010), and professional career (Endedijk, Brekelmans, Sleegers, et al., 2016).

According to Schunk (in Schraw, Crippen & Hartley, 2006) and Valle, Núñez, Cabanach, et al. (2009), self-regulation refers to the individuals' ability to understand and monitor their learning by setting goals and strategies to achieve the goals, implementing the strategies in learning, and monitoring the progress in achieving the goals. De Corte emphasized the importance of self-regulation in learning in higher education students by stated that *successful learners and problem solvers can simultaneously perform two functions: executing a task, and organizing/evaluating (=self-regulating) the task-related activities by orienting oneself to the task, planning one's approach to the task or problem, monitoring and evaluating the activities, and reflecting after a task has been performed* (p. 266). Self-regulation, therefore, is crucial competencies for success in learning (De Corte, 2016; Baez-Estradas & Alonso-Tapia, 2017).

The study of Baez-Estradas and Tapia (2017), reported that students' effort to learning will also depend on the way they regulate their learning when confronting the learning tasks. The more difficult the learning tasks are, the more negative emotions will arise that will affect the thinking process. Vermunt and Vermetten (2004) mentioned the interplay of cognitive processing strategies, metacognitive regulation strategies, conceptions of learning, and learning orientations as four important components of student learning. Based on when and how many times the students took the test, Mello (2016) analyzed students' self-monitoring of their learning process. The study of Mello (2016) indicated that more students used tests as self-assessment rather than as a way of monitoring their learning process. The study of Mello (2016) also revealed that students of higher achievers used more self-directed learning than the low achievers.

Referring to the previous explanations, then the issue to be raised in this study was what variables of self-regulated learning that support students' academic achievement. Thus, the aim of this study was to examine the correlations of four variables of self-regulated learning such as processing strategies, regulation strategies, study orientations and conceptions of learning. This study also examines the differences of four variables of self-regulated learning in terms of gender and the university.

2. Method

2.1 Sampling Technique and Sample Size

A non-random sampling technique applied in this study. In total 578 first year students [(Female n=479; 82.9%); Male n=99; 17.1%)] enrolled at Faculty of Psychology, in three universities in three big cities in Indonesia, Medan North Sumatra (n=258; 44.6%), Jakarta the capital city (n=209; 36.2%) and Surabaya East Java (n=111; 19.2%) participated in this study. The participants' age was from 17 to 23 years, and the mean age was 18.99 years. The participation was voluntarily, and informed consent was signed. The Indonesian version of Vermunt's Inventory of Learning Style (ILS) was administered in a group in a classroom.

2.2 Research Instrument

The Indonesian version of Vermunt's Inventory of Learning Style (ILS) consisted of 130 items and 4 subscales was used to measure four variables of learning, processing of learning (27 items), regulations of learning (28 items), orientation to study (35 items), and mental model of learning or conceptions of learning (40 items). Processing of learning subscale has three components, deep processing, stepwise processing, and concrete processing. Regulation of learning subscale has three components, self-regulated, externally regulated, and lack of regulation. Study orientation subscale has five components, certificate directed, vocation directed, self-test directed, personally interested, and ambivalent. Conception of learning subscale has five components, intake of knowledge, construction of knowledge, use of knowledge, stimulating education, and cooperation. A five-point Likert scale is used to rate the items. In the processing of learning and regulation of learning subscales, from "never do" to "always do". In the study orientations and conceptions of learning subscales, from "mostly disagree", to "mostly agree". The range internal consistency or the Cronbach α of the subscales was 0.53-0.81, in which the lowest is the external regulation result and the highest is deep processing. Students' GPA scores were used as the measure of academic achievement.

2.3 Data Collection Procedures and Analysis

Appropriate heads of department in each university provided permission for students' participation, and each student voluntarily participated in the research. Students signed the informed consent. Completion of the ILS was anonymous, and confidentiality was assured. The ILS was administered to the students in groups in the classrooms. Prior to the administration of ILS, the aim of the research was informed to the students. Pearson Correlation and Multiple Regression are used to determine the correlation between each scale, and the contribution of each scale to academic achievement.

3. Result

3.1 Correlations among Variables of Self-Regulated Learning

Table 1 showed that deep processing has no significant correlations with lack of regulation, certificate directed, intake of knowledge, stimulating of education and cooperation. Deep processing showed significant correlation with self-regulation in learning (r=.60; p<.01). Deep processing has significant correlations with the other two components of cognitive processing, stepwise processing (r=.60; p<.01) and concrete processing (r=.59; p<01), and two components of regulation strategies, self-regulation (r=66; p<01) and external regulation (r=.42; p<.01). Deep processing has also significant correlations with three component of study orientation, vocational directed (r=.23; p<.01), self-test (r=.24; p<.01), personally interested (r=.28; p<.01). Deep processing has significant correlations with two components of conceptions of learning, construction of knowledge (r=.44; p<.01) and use of knowledge (r=.22; p<.01). Deep processing has significant negative correlation with ambivalent (r=-.17; p<.01).

Self-regulation showed significant correlations with vocational directed (r=.28; p,.01), self-test (r=.31; p<.01), personally interested (r=.29; p<.01), and components of conceptions of learning, intake of knowledge (r=.15; p<.01), construction of knowledge (r=.53; p <.01), use of knowledge (r=.23; p<.01), stimulating education (r=.11; p<.01) and cooperation (r=.13; p<.01). Self-regulation showed negative correlation with ambivalent (r=.12; p<.01).

Table 1. Correlations among Variables of Self-Regulated Learning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Deep	1															
Stepwise	.60**	1														
Concrete	.59**	.45**	1													
Self-Reg	.66**	.64**	.53**	1												
Ext-Reg	.42**	.63**	.44**	.53**	1											
Lack-Reg	-.05	-.03	.02	-.03	.03	1										
Certificate	-.01	.10*	.02	.07	.28**	-.19**	1									
Vocational	.23**	.29**	.31**	.28**	.39**	-.01	.42**	1								
Self-test	.24**	.28**	.24**	.31**	.38**	0.9*	.43**	.58**	1							
Personally	.28**	.20**	.25**	.29**	.15**	.05	.22**	.45**	.36**	1						
Ambivalent	-.17**	-.05	-.17**	-.12**	-.05	.50**	.23**	-.09*	.07	.01	1					
Intake	.02	.25**	.14**	.15**	.43**	.22**	.46**	.44**	.44**	.25**	.24**	1				
Construction	.44**	.35**	.38**	.53**	.27**	-.11**	.10*	.35**	.43**	.45**	-.05	.28**	1			
Use	.22**	.23**	.42**	.23**	.31**	.01	.19**	.51**	.41**	.38**	.01	.50**	.47**	1		
Stimuli of	.03	.15**	.06	.11**	.27**	.23**	.28**	.29**	.28**	.28**	.25**	.69**	.21**	.30**	1	
Cooperation	.03	.09*	.10**	.13**	.20**	.16**	.19**	.17**	.25**	.08**	.21**	.41**	.20**	.22**	.33**	1

** p<.05. ** p<.01.*

3.2 Four Variables of Self-Regulated Learning as Predictors of Academic Achievement

Three components of cognitive processing strategies (deep processing r=.16, p<.01; stepwise processing (r=.24, p<.01; concrete processing (r=.17, p<.01), were significantly correlated to students' academic achievement. Multiple regression analysis was used to test if the three components of cognitive processing strategies significantly predicted students' academic achievement. The results of the regression indicated that three components of cognitive processing strategies explained 6.1% of students' academic achievement (R^2=.061, $F_{3,574}$=12.38, p<.01). Of the three components of cognitive processing strategies, stepwise processing was significantly predicted academic achievement (β=.012, p<.01).

The components of regulation strategies (self-regulation r=.14, p<.01; external regulation r=.19, p <.01; lack of regulation r=-.20, p<.01) were significantly correlated to students' academic achievement. Multiple regression analysis was used to test if the three components of regulation strategies significantly predicted students' academic achievement. The results of the regression indicated that three components of regulations strategies explained 8.2% of academic achievement (R^2=.082, $F_{3,574}$=16.99, p<.01). Of the three components of regulations strategies, external regulation was significantly predicted academic achievement (β=.018, p<.01), and lack of regulation was significantly negative in predicting academic achievement (β=-.207, p<.01),

Not all components of study orientation have correlations with students' academic achievement. Only certificate directed (r=-.069, p<.05) and ambivalent (r=-.169, p<.01) that were significantly correlated negatively to students' academic achievement. Thus, multiple regression was processed only for certificate directed and ambivalent. The results of the regression indicated that the certificate directed and ambivalent explained 3% of academic achievement (R^2=.030, $F_{3,574}$=8.752, p<.01). Of the components of study orientation, ambivalent was negative predictor for academic achievement (β=-.162, p<.01),

Three components of conceptions of learning were significantly correlated to academic achievement (use of knowledge processing (r=.10, p<.01; stimulating education (r=-.11, p<.01; cooperation (r=-.21, p<.01). Multiple regression analysis was used to test if the three components of conceptions of learning significantly predicted students' academic achievement. The results of the regression indicated that three components of conceptions of learning explained 8.9% of academic achievement (R^2=.089, $F_{3,574}$=11.18, p<.01). Of the three components of conceptions of learning, use of knowledge was significantly predicted academic achievement (β=.18, p<.05). Meanwhile, stimulating education (β=-.100, p<.01), and cooperation (β=-.213, p<.01), were negatively in predicting academic achievement.

3.3 Gender Differences on Variables of Self-Regulated Learning

The scores of self-regulated learning variables measured in this study were not normally distributed, thus the Mann-Whitney U test was used to analyze gender differences on variables of self-regulated learning. A Mann-Whitney test indicated that female was greater than male in stepwise processing (*U*=19686.5, *p*=.008, *r*=.11), self-regulation (*U*=18730.5, *p*=.001, *r*=.14*)*, external regulation (*U*=16609.5, *p*=.00, *r*=.20), certificate directed (*U*=18550.5, *p*=.001, *r*=.14), vocational directed (*U*=19322.5, *p*=.004, *r*=.12), self-test (*U*=19161.0, *p*=003, *r*=.13), intake of knowledge (*U*=18008.5, *p*=.00, *r*=.16), use of knowledge (*U*=19722.5, *p*=.008, *r*=.11), and stimulating education (*U*=20318.5, *p*=.025, *r*=.09).

3.4 University Differences on Variables of Self-Regulated Learning

The result of this study indicated that there were statistical differences on the variables of self-regulated learning among three universities. Stepwise processing (χ^2=15.44; p=.00) with a mean rank of 331.60 for Jakarta, 314.29 for Surabaya, and 269.83 for Medan. Concrete processing (χ^2=7.72; p.021) with a mean rank of 332.44 for Surabaya, 308.28 for Jakarta, and 280.26 for Medan. External regulation (χ^2=18.66; p=.00) with a mean rank of 337.71 for Jakarta, 307.47 for Surabaya, and 268.08 for Medan. Certificate directed (χ^2=10.97; p=.004) with a mean rank of 321.65 for Jakarta, 303.36 for Medan, and 260.37 for Surabaya. Vocational directed (χ^2=10.28; p=.006) with a mean rank of 314.55 for Medan, 309.06 for Jakarta and 256.35 for Surabaya. Self-test (χ^2=11.62; p=.003) with a mean rank of 326.92 for Medan, 288.95 for Jakarta, and 266.83 for Surabaya. Ambivalent (χ^2=13.12; p=.001) with a mean rank of 317.95 for Jakarta, 308.70 for Medan, and 255.41 for Surabaya. Intake of knowledge (χ^2=6.88; p=.032) with a mean rank of 320.90 for Jakarta, 294.88 for Medan, and 279.64 for Surabaya. Construction of knowledge (χ^2=9.84; p=.00) with a mean rank of 324.32 for Medan, 292.06 for Jakarta, and 266.98 for Surabaya.

4. Conclusion and Discussion

The results of this study revealed that the interplay of four variables of self-regulated learning, namely cognitive processing strategies, regulations strategies, study orientations and conceptions of learning significantly correlated. The study also indicated that for cognitive processing strategies, students of the three universities applied more stepwise processing rather than deep processing and concrete processing. Students at the university in Jakarta used more stepwise processing than the other two universities. For the components of regulations strategies, the study indicated that external regulation was significant predictors of students' academic achievement, while lack of regulation was a negative predictor of academic achievement. Previous cross-cultural studies on the patterns or styles of learning reported that the perceptions of course requirements influenced students' approach to learning and that the learning patterns are related to the local cultures. Learning patterns of Asian students different from the Western students (Volet & Renshaw, 1996; Wong, 2004; Marambe, Vermunt & Boshuizen, 2012), and that also the case of Indonesian students who showed as a "passive recipient in their cognitive

strategies and regulations strategies of learning" (Ajisuksmo, 1996; Ajisuksmo & Vermunt, 1999). The learning patterns of the Indonesian are also related to the assessment systems that require students to remember and to reproduce their learning. Analytical and critical thinking as a deep approach in learning are rarely emphasized in learning, though students' centered learning is implemented. A further study on what factors influenced the cognitive strategies, regulations strategies, study orientation and conceptions of learning in higher education should be carried out, as well as method of delivering knowledge and skills which is appropriate in fostering deep and active processing of learning and self- regulations of learning.

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