The Influence of Processing and Regulation of Learning on Academic Achievement Amongst First Year Undergraduate Psychology Students in University of North Sumatra

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ABSTRACT

Transition of learning from secondary to higher education demands new students to do academic adjustments, especially towards the change from rote learning to student-centered learning. Student-centered learning requires students to process learning material with more depth and to regulate their own learning. These skills often relate with academic achievement. The purpose of this study was to investigate the influence of processing and regulation of learning conducted by first-level students on academic achievement. Other factors that affect academic achievement were explored too, such as student's sex, parental support, conception of learning, and learning orientation . This study used mixed method. Quantitative data was obtained through Inventarisasi Cara Belajar (ICB) or Learning Style Inventory, which was filled by 180 third-semester students. ICB was used for measuring the processing and regulation of learning and their effect on academic achievement, which is depicted by Grade Point Average (GPA). Qualitative data was obtained through group interviews. Results of the study indicate that lack of regulation is the only one variable that can predict student academic achievement with a negative correlation. Several other factors were found to affect student academic achievement, including learning orientation, learning conceptions, learning motivation, academic commitment, and parental support. Researcher then designed a training based on reciprocal-teaching approach as an intervention with students as the participant.

KEYWORDS: *Processing of Learning, Regulation of Learning, Academic Achievement, Higher Education, First Year Student.*

INTRODUCTION

Attending university can be a challenging experience for most of the new undergraduate students. Students are faced with new demands or challenges in the transition from high school to university, such as less time to do leisure activity due to the high demand for studying, concerns of own academic capabilities, doubts about the prospects of study that can be obtained, and so forth. The less-structured system of higher education also brings an uncertainty or ambiguity to university freshmen in pursuing the study. Exploration and commitment of the students are required in order to develop their vocational identity in the future.

These demands in the university serve to prepare students for the competitive future, as higher education is a fine asset for future generation (Castro & Levy, 2015; Ford, 2017). In line with the effort for achieving that goal, student-centered learning is implemented as a fundamental principle in higher education system. Student-centered learning is an approach in which learners play an active, interactive, and responsible role in their learning. Learners acquire opportunities to choose not only what to study, but also how and why (Harsono, 2008; TEAL, 2010; Wright, 2011; Oinam, 2017). Learners do not passively take in the information that are provided; however learners are likewise in charge of building and developing their own knowledge and experience.

Several methods and strategies of teaching are employed in student-centered learning. These methods and strategies include supporting students to reach material understanding by using critical thinking, providing responsibilities in students to regulate their own learning, as well as developing and using effective learning in every task (Wright, 2011; Oinam, 2017). Furthermore, assignments in student-centered learning stimulate learner to not merely using rote memorization, but also utilize meaningful learning. Meaningful learning can benefit learners in problem-solving skill and deeper understanding in learning a new concept (Mayer, 2002; Vallori, 2014).

Student-centered learning is, therefore, relevant to processing of learning and regulation of learning. Processing of learning refers to activities that are employed by students to process learning contents (Vermunt & Rijswijk, 1988; Vermunt, 1996; 1998; 2005), such as relating parts of subject matter to each other, relating course content to concrete things, examining specific details of course content thoroughly, structuring parts of subject matter into an organized knowledge, drawing own conclusion of the material based on facts and arguments, or rehearsing content for a number of times. Meanwhile, regulation of learning refers to learning actions that are conducted to organize and regulate the processing activities (Vermunt & Rijswijk, 1988; Vermunt, 1996; 1998; 2005). These regulation activities include planning the learning objectives and learning activities, monitoring the learning activities that can lead to desired outcome, testing one's understanding of learning content, evaluating, and reflecting the learning process.

Vermunt categorized processing of learning into three types, deep processing, stepwise processing and concrete processing (Vermunt & Rijswijk, 1988; Vermunt, 1996; 1998; 2005). Deep processing is learning process in which students relate learning contents to each other

and pre-knowledge, structuring into a whole knowledge, and processing critically parts of the course content. Stepwise processing refers to memorising, rehearsing, and analysing specific details activities that are used to process learning content. Concrete processing is learning process in which students personalising subject matter by relating them to own experiences or using them outside the study context.

Regulation of learning is categorized into three types as well (Vermunt & Rijswijk, 1988; Vermunt, 1996; 1998; 2005), which are self-regulation, external regulation, and lack of regulation. Self-regulation is the situation where students regulate their own learning process, while external regulation is a condition in which students let their learning process be regulated by external sources. Meanwhile, students who do not have strategies in regulating their own learning process, and also facing difficulties in grasping the regulation information provided by teacher or lecturer is experiencing lack of regulation.

Students' processing of learning and regulation of learning are related with their academic achievement (Vermunt, 1996; Heikillå & Lonka, 2007). Vermunt (1996) stressed the importance of deep and concrete processing, as well as self-regulation to bring a better academic achievement. Chan (2011) also found a positive correlation between deep processing and academic achievement. Critical processing, as a part of activities in deep processing, can also predict students' Grade Point Average (Boyle, Duffy, & Dunleavy, 2003; Vanthournout, Gijbels, Coertjens, Donche, & Petegem, 2012). Donche and Petegem (2011) stated that concrete processing is a good strategy in predicting first year undergraduate students' GPA. Ertmer and Newby (1996) found that students with self-regulation tend to achieve a better academic performance. Heikillå and Lonka (2007) also explained that there is positive relationship between self-regulation and academic achievement, while external regulation and lack of regulation correlate negatively with academic achievement.

Contribution of processing and regulation of learning in higher education on academic achievement has been explained accordingly. Build upon by above explanation, this study aimed to identifies the processing of learning and regulation of learning among first year undergraduate psychology students in University of North Sumatra. This study also intended to examine the difference of processing and regulation of learning between high-GPA students and low-GPA students. Other factors that influence students' academic achievement is also targeted for further explanation.

METHODOLOGY

Participants

This study employed a mix-method approach (quantitative and qualitative). A total of 180 third-term students (age 17-21) were selected to participate in filling the questionnaire. The quantitative participants comprised of 142 females (79%) and 38 males (21%). For the qualitative purpose, a total of 17 students (age 18-20) were purposively selected to participate in the group interview. The qualitative participants consisted of 11 females (65%) and 6 males (35%).

Measures

For quantitative purpose, Inventarisasi Cara Belajar (ICB) that was adapted from *Inventaris Leertijlen* by Ajisuksmo (1996) was implemented in this study. ICB consist of two parts, part A (processing of learning and regulation of learning) and part B (study orientation and conception of learning). Only part A was used in this study. A five-point Likert scale is used to rate the items, ranging from "never do" to "always do." The range of the internal consistency or Cronbach α on each subscale was 0.52-0.82, in which the lowest was external regulation result and the highest was deep processing and self-regulation.

For qualitative purpose, group interviews were conducted in four groups, which was categorized based on Grade Point Average (GPA). There were two groups of students with high GPA and two groups of students with low GPA. The questions asked in group interview were about processing of learning, regulation of learning, and other factors that influence students' academic achievement. These questions were validated by professionals in this field. To assure participants understand the questions, a try-out group was conducted. This is also to ensure that given answers by participants can cover the measured construct.

Procedures

The vice dean of Faculty of Psychology was contacted for permission to have students participate in the study. After gaining the permission from the vice dean, researcher approached some lecturers of the class to ask their willingness for sharing their regular teaching time to administer ICB to the students. Each student signed the informed consent. Confidentiality was assured as well. Prior to the administration of ICB, purpose of the research was informed to the students. Pearson Correlation and Multiple Regression were used to determine the correlation between each scale, and the contribution of each scales to academic achievement. Whilst doing test analysis using SPSS Program, researcher contacted some students that have been selected purposively to participate in group interview. Every student who participated signed the informed consent then group interview was conducted.

RESULTS

Processing of Learning and Regulation of Learning among Participants

To address the first objective of this study, students' processing of learning and regulation of learning were initially analysed using descriptive statistics. Since every student can adopt each types of processing of learning and regulation of learning, depends on the context at hand, hence the description of these two variables were analysed using mean and standard deviation to identify which processing of learning and regulation of learning were most frequently used by students. Concrete processing was found to be the most used processing of learning by students ($M = 3.25$, $SD = 0.65$), followed by stepwise processing ($M = 3.02$, $SD = 0.58$), then deep processing ($M = 2.91$, $SD = 0.64$). For regulation of learning, the most frequent done by students is external regulation ($M = 3.16$, $SD = 0.56$), followed by self-regulation ($M = 3.05$, $SD = 0.69$) and lack of regulation ($M = 2.96$, $SD = 0.61$).

Intercorrelation of Variables

The next objective of this study was to determine the influence of processing of learning and regulation of learning on academic achievement during the first year. To address this objective, Pearson correlation was conducted beforehand to establish the relationship between each predictor variables with academic achievement (GPA score). This correlational analysis was carried out since identification of the relationship was required to determine which predictors will be processed to multiple regression analysis.

Table 1

Intercorrelation of Variables

	GPA	Deep Processing	Stepwise Processing	Concrete Processing	Self-Regulation	External Regulation	Lack of Regulation
GPA	1.00	.19**	.20**	.19**	.20**	.19**	-.17**
Deep Processing	.19**	1.00	.73**	.64**	.76**	.61**	.00
Stepwise Processing	.20**	.73**	1.00	.54**	.73**	.68**	-.04
Concrete Processing	.19**	.64**	.54**	1.00	.61**	.56**	.02
Self-Regulation	.20**	.76**	.73**	.61**	1.00	.63**	-.02
External Regulation	.19**	.61**	.68**	.56**	.63**	1.00	.03
Lack of Regulation	-.17**	.00	-.04	.02	-.02	.03	1.00

Note: N = 180; ** : Pearson Correlation is significant at 0.01 level; * : Pearson Correlation is significant at 0.05 level

All relationship of predictor and outcome variable are significant. Therefore, all predictor variables were involved in multiple regression analysis. Findings in Table 1 indicate that Deep Processing (r = 0.19, $p < 0.01$), Stepwise Processing (r = 0.20, $p < 0.01$), Concrete Processing (r = 0.19, $p < 0.01$), Self-Regulation (r = 0.20, $p < 0.01$), and External Regulation (r = 0.19, $p < 0.01$) correlate positively and significantly with students' academic achievement. Meanwhile, Lack of Regulation is negatively associated with academic achievement (r = -0.17, $p < 0.01$).

Effect of Processing of Learning and Regulation of Learning on Academic Achievement

Results in Table 2 show that processing of learning and regulation of learning were proven to be significant predictors of students' academic achievement, with $F(6, 173) = 2.59$, $p < 0.05$. In total, overall processing of learning and regulation of learning employed by students were pointed out to account for 8% of the variance ($R^2 = 0.08$) in their academic achievement. However, as can be seen in Table 3, not all predictor variables contribute significantly to academic achievement.

Table 2

Multiple Regression Analysis of Processing of Learning and Regulation of Learning as Predictors of Academic Achievement

		Academic Achievement		
		$F (6, 173) = 2.59, p < .05; R^2 = .08$		
Model	Variables	β	t	Sig.
1	Deep Processing	.02	.17	.86
	Stepwise Processing	.05	.43	.67
	Concrete Processing	.08	.83	.41
	Self-Regulation	.04	.31	.76
	External Regulation	.07	.68	.50
	Lack of Regulation	-.18*	-2.39	.02

In this generated model, the result showed that academic achievement was significantly predicted by Lack of Regulation ($\beta = -0.18$, $t = -2.39$, $p < 0.05$). The produced negative amount indicates negative relationship between lack of regulation and academic achievement. Meanwhile, academic achievement was not significantly predicted by Deep Processing ($\beta = 0.02$, $t = 0.17$, $p > 0.05$), Stepwise Processing ($\beta = 0.05$, $t = 0.43$, $p > 0.05$), Concrete Processing ($\beta = 0.08$, $t = 0.83$, $p > 0.05$), Self-Regulation ($\beta = 0.04$, $t = 0.31$, $p > 0.05$), and External Regulation ($\beta = 0.07$, $t = 0.68$, $p > 0.05$).

Difference of Processing of Learning and Regulation of Learning between High-GPA Students and Low-GPA Students

Based on the collected data, comparison analysis was concluded to see if there is any difference in processing of learning and regulation of learning between high-GPA students and low-GPA students. Comparison analysis was carried out by using independent sample *t*-test. The following table portrayed the results of the conducted comparison analysis.

Table 3

Independent Samples Test in Processing of Learning and Regulation of Learning between High-GPA Students and Low-GPA Students

Variables	GPA	Mean	t	Sig.
Deep Processing	High	33.13	1.65	.102
	Low	30.71		
Stepwise Processing	High	35.18	2.11*	.037
	Low	32.24		
Concrete Processing	High	17.09	2.23*	.029
	Low	15.56		
Self-Regulation	High	35.51	1.87	.065
	Low	32.62		
External Regulation	High	36.40	2.39*	.019
	Low	33.44		
Lack of Regulation	High	16.78	.54*	.017
	Low	18.60		

Results in Table 3 show that there are differences in stepwise processing, concrete processing, external regulation, and lack of regulation between high-GPA students and low-GPA students. High-GPA students scored higher on stepwise processing ($t = 2.11$, $p < 0.05$), concrete processing ($t = 2.23$, $p < 0.05$), and external regulation ($t = 2.39$, $p < 0.05$). Meanwhile, low-GPA students scored higher on lack of regulation ($t = 0.54$, $p < 0.05$).

Sex difference in Processing of Learning and Regulation of Learning

Additional independent *t*-test was done to see if there is any difference in processing of learning and regulation of learning between female and male students. Table 4 depicted the results of sex difference in processing of learning and regulation of learning.

Table 4

Independent Samples Test in Processing of Learning and Regulation of Learning between Female and Male Students

Variables	Sex	Mean	t	Sig.
Deep Processing	Female	32.49	1.94	.05
	Male	30.03		
Stepwise Processing	Female	33.60	1.43	.15
	Male	31.95		
Concrete Processing	Female	16.49	1.71	.09
	Male	15.47		
Self-Regulation	Female	34.20	2.00*	.047
	Male	31.45		
External Regulation	Female	35.46	2.86**	.005
	Male	32.32		
Lack of Regulation	Female	17.92	.85	.40
	Male	17.34		

Results in Table 4 show that there are differences in self-regulation and external regulation between male and female students. Female students scored higher on both self-regulation ($t = 2.00$, $p < 0.05$) and external regulation ($t = 2.86$, $p < 0.01$). This shows that female students tend to regulate their learning better than male students.

Group Interview

Group interviews were conducted in four groups, consist of two groups with high-GPA students and two groups with low-GPA students. Students with high GPA showed a tendency to use concrete processing to gain an understanding of course content. Stepwise processing was employed by high-GPA students as well, but it was used primarily to memorize definition or key term that was considered important. Analysing course content in detail, that is part of stepwise processing activity, was used by few high-GPA students either to understand the subject matter. Meanwhile, deep processing was rarely used by students. Only one out of 17 students from group interview participants was found to adopt deep processing activity in his learning.

Contrary to high-GPA students, neither concrete processing nor analysing activity in stepwise processing were employed by low-GPA students. Students with low GPA relied on rehearsing activity to understand a subject matter. Memorizing activity was also employed

when students failed to understand the course content. Some students with low GPA tend to memorize the subject matter without prioritizing the knowledge gained. Students only focused on achieving a minimal score to pass the courses.

In terms of regulation of learning, students with high GPA leant on external regulation to coordinate their learning, such as assignments from lecturer, quiz, or examination schedule. Students also did evaluation and reflection to identify the cause of low-test score that they obtained. The result of evaluation and reflection were aimed to construct new strategy for their learning. Some students with high GPA also regulated their learning occasionally with own initiative, such as reading a book in the spare time and testing their understanding of subject matter through discussion with other students or by reading research papers. However, on the second term, lack of regulation was incorporated with external regulation in their study. Lack of regulation in high-GPA students was due to massive workload that needed to be done. As a consequence, students had no strategy in sparing their time to read textbook. Motivation decreased in addition as a result of the piling tasks.

In line with high-GPA students, students with low GPA relied on external regulation in their learning as well. Nevertheless, low-GPA students carried out the demands because they felt compelled. Avoidance of consequences was the other reason for students to engage with the demands. Lack of regulation was also conducted frequently by low-GPA students. Students tend to ignore their responsibility. Despite the fact that high-GPA students incorporate lack of regulation in their learning, students with high GPA always submit their assignments. Contrary to high-GPA students, students with low GPA had low attendance rate and did not submit their assignments. In addition, low-GPA students were less able to evaluate the cause of their failure. When they tried to formulate a new strategy in learning, they only opted to increase the frequency of their study activity, without yielding a specific strategy. Students with low GPA rarely read books as well. They simply depended on other students' reports, record summaries, google translate, and internet blogs for their study.

The findings also revealed other factors that influence students' academic achievement. Students with high GPA tend to view learning as a process for constructing knowledge. Meanwhile, majority of students with low GPA tend to view learning as intake of knowledge. In terms of study orientation, students with high GPA were found to be vocational directed, self-test directed, and personally interested. In distinct, students with low GPA were certificate directed. Students with high GPA were also found to have a high academic commitment. On the contrary, students with low GPA were revealed to have a low academic commitment. Parental support and family stress were also identified as factors that influence students' academic achievement.

DISCUSSION

Findings in this study has demonstrated that lack of regulation was the only significant variable that contributed negatively to academic achievement. This finding supports the notion that lack of regulation correlates negatively with academic achievement (Donche & Petegem, 2011; Heikillå & Lonka, 2007; Vermunt, 2005). This result was also in line with data obtained from independent *t*-test and group interview, which showed that students with low GPA tend to not

regulate their learning well. When students with high GPA incorporated lack of regulation in second term of the study, decline in academic achievement was noticed as well.

Self-regulation and external regulation were found to have no significant contribution on academic achievement. This result claims that how students regulate their learning is not as important as the fact that they regulate their learning. Lack of regulation in this respect was a better predictor on lower academic achievement than the way students regulate their learning, which were self-regulation or external regulation. This result supports some of the previous findings that showed only lack of regulation is the significant predictor for lower academic achievement in first year student (Busato, Prins, Elshout, & Hamaker, 1999; Vermunt, 2005; Donche & Petegem, 2011).

In terms of processing of learning, no significant contribution was found on academic achievement. This finding shows that how students process course content is also less important as long as they regulate their learning process. However, based on the findings obtained from group interview, processing of learning was found to act as a mediating variable between other factors on academic achievement.

The other factors that were found to affect students' academic achievement are conception of learning, study orientation, academic commitment, and family support. First, conception of learning. Conception of learning relates with students' view on what learning is (Vermunt & Rijswijk, 1988; Vermunt, 1996; 1998; 2005). High-GPA students tend to view learning as a mean for knowledge construction, while low-GPA students perceive learning as a process of increasing the quantity of knowledge. How students regulate and process their learning will be influenced by their perception on what learning means to them (Vermunt & Rijswijk, 1988; Vermunt, 1996; 1998; Richardson, 2010).

Students who merely see learning as a means for intake of knowledge tend to memorize and rehearse the information (Ajisuksmo, 1996; Vermunt & Rijswijk, 1988; Vermunt, 1996; 1998; 2005), as can be seen on low-GPA students. Meanwhile, students who perceive learning as a process of knowledge construction tend to develop some strategies to achieve learning content understanding (Ajisuksmo, 1996; Vermunt & Rijswijk, 1988; Vermunt, 1996; 1998; 2005). High-GPA students showed that they employed few processing activities for knowledge construction, such as memorizing key terms, analysing content in detail, concretizing and personalizing course content to own experience and using them outside the study context, relating new information to previous knowledge, and structuring them to a whole new knowledge. They also regulate their learning better than low-GPA students.

The second factor that was found to affect students' academic achievement was study orientation. Students with high GPA has an intention to gain understanding in their study. This understanding that students yearned for was aimed to acquire professional skill and get a decent job in the future. Another goal that high-GPA students tried to achieve was self-test directed, which means the learning regulation and processing that students did were intended to prove to themselves and other people that they have the ability to master the learning. Meanwhile, low-GPA students tend to have a certificate-directed orientation, which targeted on achieving minimal passing grades and obtaining the degree. Difference in study orientation also affects

how student regulate and process their learning (Vermunt, 1996; 1998; Balapumi, Konsky, Aitken, & McMeekin, 2016).

Students with high GPA, even though sometimes faced with difficulties to regulate their learning, during the study, high-GPA students still tried their best to achieve understanding of the subject matter by mostly engaged in concrete processing. Contrary to high-GPA students, low-GPA students with certificate-directed tend to utilize stepwise processing as a shortcut to obtain minimal passing grade without trying to understand the learning content. Few participants from low-GPA students group notified that it was hard for them to understand the subject matter. High-GPA students also showed interest on few subject matter. Students who are personally interested with learning content tend to have higher learning motivation. High level of motivation drive students to regulate their learning better, as opposed to low interest with the learning content (Mahmoodi, Kalantari, & Ghaslani, 2014; Vermunt, 1998; Pintrich, 2000).

Academic commitment was the third factor that influenced students' academic achievement. High-GPA students showed higher academic commitment than low-GPA students. Academic commitment in high-GPA students was seen through the physiological commitment, goal commitment, and task commitment. Physiological commitment refers to assigning mental resources, such as direct attention and sustain concentration on learning task (Human-Vogel & Rabe, 2015). Task-level commitment implies decisions made to complete a task by investing time and effort. High-GPA students always tried their best to complete a task, meanwhile several students with low GPA did not finish and hand over their assignments. Goal commitment involve goal setting such as learning for an exam or complete the course in a specific time (Human-Vogel & Rabe, 2015). Goal-driven task commitments increase the coherence of a students' learning behaviour because tasks that help to accomplish a learning goal, will be preferred over tasks that are irrelevant to goal attainment. Both students with high GPA and low GPA had a goal to complete the course in a specific time. However, high-GPA students were found more likely to report behaviours consistent with that goal, such as setting learning goals or managing their studies to achieve their learning goals. Low-GPA students tend to prefer leisure activity over task that help them to achieve their learning goal.

Lastly, external factor was also found to affect students' academic achievement. Parental support was found to influence students' academic achievement indirectly. When parents support students with their choice to study in Psychology, students tend to feel more motivated to regulate their learning (Balapumi, et al., 2016; Gutman, 2006). In contrast, when parents do not support the choice that students made, mainly when students are facing with grade decline, student's motivation to learn decrease as well. As a result, students will not regulate their learning well. How students regulate their learning will eventually affect their academic achievement.

Next, explanation for differences in self-regulation and external regulation that occurred between female and male students were provided. Differences that were found can be explained by several possibilities. First, the choice of study. There are different study options generally chosen by women and men (Turner & Bowen, 1999; Barres, 2006). Women have a tendency to be more interested in Art and Social studies, while men tend to prefer Science

studies. This is also supported by the data obtained that the number of female participants studying at the University of North Psychology Faculty far outweighs male participants. This interest in Social studies can be one of the reasons behind the regulation of learning done by female participants. Interest in a subject matter can drive a person to regulate the learning better (Schunck, Pintrich, & Meece, 2010; McWhaw & Abrami, 2001).

The second factor might be explained by the tendency in woman to be more interested in cooperative learning with others (Vermunt, 2005) and more willing to seek help when facing difficulties than man (Virtanen & Nevgi, 2010). Therefore, these differences can also influence female students to regulate their learning better. Nevertheless, due to the inconsistent results of sex difference in learning regulation between the studies, further explanations regarding these differences are also not yet developed.

CONCLUSION

The findings of this study propose that regulation of learning done by first year university student was an important predictor for their academic achievement. The fact that they regulate their learning was more important than the way they regulate or process their learning. This might be caused by the difference in educational system between high school and higher education. Higher education employs student-centered learning in the study, which requires students to be responsible on their own learning. Since students are obligated to coordinate their own learning, regulation of learning can be a crucial factor for their academic achievement.

The way students regulate and process their learning had played a role as a mediating variable between conception of learning, learning orientation, and academic achievement. Students who viewed learning as construction of knowledge and were personally interested with the subject matter tend to regulate their learning better and employed deep and concrete processing in their study. This condition also happened under vocational directed and self-test orientation. Hence, students acquire higher GPA as well. On the contrary, low-GPA students tend to view learning as intake of knowledge and has a certificate-directed orientation. Thus, students with low GPA tend to less regulate their learning and engaged in stepwise processing in order to memorize the course content with no regard on knowledge understanding. Parental support was also found to affect students' academic achievement indirectly. Students who received support from their parents tend to feel more motivated afterwards. Hence, they regulate their learning better. Conversely, if parents gave reprimand instead of advice, students would be less willing to regulate their learning. Problems faced in a family also influenced students' motivation to study.

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