



AMERICAN
SCIENTIFIC
PUBLISHERS

Copyright © XXXX American Scientific Publishers
Letters
All rights reserved
Printed in the United States of America

Advanced Science
Vol. XXXXXXXXX

ENHANCING STUDENTS' SELF REGULATED LEARNING AND ACHIEVEMENT THROUGH METACOGNITIVE AND COGNITIVE STRATEGY TRAINING

Ucu Rahayu¹, Ari Widodo² and Tri Darmayanti³

¹Faculty of Teacher Training and Education, Universitas Terbuka, Tangerang Selatan, Indonesia

²Faculty of Mathematics and Science Education, Universitas Pendidikan Indonesia, Bandung, Indonesia

³Faculty of Law, Social and Politics Science, Universitas Terbuka, Tangerang Selatan, Indonesia

The ability of self-regulated learning (SRL) plays a role in the success of learning of Distance Education student. Self-regulated learning skills can be trained to students in various ways. This research is a mixed method with one group pretest post design. The purpose of this research is to see the influence of learning strategy in the form of metacognitive and cognitive strategies integrated into the online tutorial of Anatomy and Human Physiology course. The sample of this research is 20 students of Universitas Terbuka, Indonesia who follow the online tutorial of Anatomy and Human Physiology course in academic year 2016.1. SRL is measured at the beginning and end of online tutorials using a modified MLSQ questionnaire. Learning outcomes are measured by pretest at the start of learning and posttest at the end of the lesson. To complete the results of research, it is also conducted interviews, observations, and recordings in the field. The results showed that there was a significant difference for students' SRL and learning outcomes.

Keywords: metacognitive, cognitive, self-regulated learning, distance education.

1. INTRODUCTION

One of the skills that learners must have in the 21st century is the ability of learners to control and manage their own learning process. This is in accordance with other expert¹ which states that since twenty years ago, learners are expected to be actively involved in organizing and reconstructing the knowledge that they already possessed with new knowledge rather than as a passive absorber. A person who has the ability in self-regulated learning tends to have better performance than those who do not². Particularly, for the distance students, self-regulated learning (SRL) is an absolute skill that the learners must possess. This is due to the separation between learners and teachers in the distance environment^{3,4}. Distance students ideally should have high skills of SRL to succeed in their studies. Nevertheless, SRL's Indonesian distance students only at the average level^{5,6}.

Self-regulated learning is a process involving students in regulating and managing complex learning activities in order to achieve their academic goals⁷. SRL is an active and constructive process of the learners in which learners set goals, then monitor, regulate and control their cognitive, motivational and behavioral goals⁸. So some experts conclude SRL includes the interaction of components of cognition, metacognition, and motivation^{9,10,11}. Cognitive components include activities that support students in manipulating academic content. Metacognition strategy refers to the knowledge and ability of students in managing their cognitive activities. The motivational component, particularly self-efficacy, is considered a major factor supporting the success of the study⁹. SRL process are forethought, performance or volitional control, and self-reflection¹². The forethought phase precedes the actual performance and refers to the process that governs the stages of action. Volitional control phases include processes that occur during learning and affect attention and action. During the self-reflection phase, people respond to their efforts¹³.

One characteristic of distance education students is the autonomous learner¹⁴ which is interpreted as a freedom for students to decide what and how to learn. As an autonomy student, distance education students should have the ability to determine what will be learned, what learning resources will be used to support their learning and self-evaluation of learning completeness¹⁵. This is in line with the characteristics of students who have self-regulated learning ability where students are able to organize, control and manage their learning activities so they are able to achieve academic goals¹⁶. SRL is a very important factor in the distance environment due to limited support provided by the instructor or colleagues in completing the study⁹.

The development of fourth generation of distance

education is a flexible learning model, where learning is delivered through internet utilization or online learning¹⁷. Students participating in online learning increased approximately 19% from 2002 to 2008¹⁸. Online learning students should have a high degree of responsibility and SRL. SRL can be trained both in face-to-face learners and online. Training of SRL through various means, including tools note matrix note taking and prompt self-monitoring¹⁹, time management tools²⁰, eportfolio²¹.

Self-monitoring and self-reflection are important aspect of applying metacognitive strategies because learners get feedback related to their performance²². Self-monitoring of learning strategies, time management and self-reflection is a strategy of metacognitive application. Monitoring is conducted to control whether a predetermined strategy or planning and study time management can be implemented and successful. If not accomplished or unsuccessful, it should be sought the cause and how the solution.

Mind mapping is a tool to represent an idea connected with a central theme. The main rule of mind mapping is to bring the imagination and mind that is in the brain²³. Other experts states that mind mapping is a technique that can improve creativity and improve student learning outcomes²⁴. Mind mapping can be a feedback for teachers regarding the mental structure and development of their students, helping students to recall the knowledge gained through visual elements and can be used as an activity involving students in a lesson. Teachers can find out whether their students understand the material by establishing the correct structure related to the information it obtains in mind mapping²⁵. In addition, mind mapping helps students assimilate new knowledge to think and develop conceptual schemes. So that mind mapping was considered as a map that can be used in teaching constructivism IPA.

Furthermore, in this study, we are keen to find out whether there is a difference of students' SRL and learning outcomes before and after training of metacognitive strategies through self-monitoring and reflection and cognitive strategies through mind mapping, answering questions and discussions.

2. RESEARCH METHOD

This research was mixed methods embedded research. The research design is one group pretest and posttest design. The independent variable of this study is SRL training that is integrated into the online tutorial process. The dependent variable of this study is students' SRL and learning outcomes. The study was conducted in the academic year 2016.1.

The population of this study are 40 students, all students who access the online tutorial of Anatomy and Human Physiology in 2016.1. The sample of this research is 20 students who follow the online tutorial of Anatomy and Human Physiology course and received the book "CERDAS learning strategy guide for science education

students of distance education". One of contents of this guide is about the implementation of metacognitive strategies through monitoring and self-reflection and the application of cognitive strategies in the form of mind mapping²⁶.

The instrument used is the modified MLSQ²⁷ (motivation for Learning Strategy Questionnaire), using Likert scale (1 = never; 2; rarely; 3 = often; and 4 = very often). Instruments include the dimensions of motivation, and learning strategy. While the dimension of motivation consists of sub aspects of intrinsic and extrinsic motivation and self-efficacy. Dimensions of learning strategy that includes goal setting, goal accomplishment, goal accomplishment in science, and objectives of science, monitoring, time management, arranging place to study, effort regulation, self-evaluation and self-reflection. Instrument consists of 40 valid items with reliability level ($r = 8.6$ at $\alpha = 1\%$).

The pretest and posttest used are standard tests from item bank. The set of pretest and posttest consists of 50 items. Pretest is conducted maximum about time span of 1.5 hours. Posttest is a final exam of the semester conducted maximum about 1.5 hour time span. Online tutorial is implemented 8 weeks. Metacognitive and cognitive strategy were trained every week. Metacognitive strategy is in the form of time management, self-monitoring and self-reflection. Cognitive strategy is in the form of mind mapping, composing questions and answers, and engaging in discussions.

3. DATA ANALYZE

The data of this research is the average score of SRL before and after online tutorial and score of pretest and posttest. To know the difference of the average score of early SRL and final SRL, it was analyzed by using t test. Furthermore, the increase of SRL scores and learning outcomes was analyzed by calculating the normalized gain using the formula as follows²⁸:

$$g = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

Prior to the analysis, prerequisite tests are tested on the normality of one sample by using Kolmogorov-Smirnov test and homogeneity test using Levene's test of equality of error variance. Data were analyzed using SPSS 17 for window. In addition, it was tested a difference of average scores of dimensions between before and after online learning.

4. RESULTS AND DISCUSSIONS OF THE RESEARCH

The results of the normality test of one sample Kolomogorov Smirnov showed that the data were normally distributed ($p > 0.05$) and homogeneity test using levene's test of equality of error variance, indicating that the data homogeneous ($p > 0.05$).

The early and final of average score of SRL

The results of the t-test using indicate that the initial average score of SRL is significantly different from the average score of end-SRL ($p < 0.05$). It showed that the training of metacognitive and cognitive strategies that are integrated into the online tutorials are beneficial to the improvement of students' SRL that follow the online tutorial of Anatomy and Human Physiology courses. The results of the study are in line with the results of previous studies which suggest that providing a combination of cognitive and metacognitive strategies efficiently improves the ability of SRL²⁹. In his research, he combines learning methods during learning, such as self-evaluation and reflection activities, as well as teaching methods including concept maps, and note-taking strategies²⁹. The results of his research prove that the learning strategies used lead to different learning outcomes before and after treatment, but stronger differences are obtained through the use of metacognitive strategies. This suggests that training is efficient against the improvement of metacognitive strategies of students. This is in line with other expert which states that the ability of students' SRL can be improved through systematic intervention³⁰. Interventions can be training related to learning strategies or metacognitive strategies.

Furthermore, the mean sub-dimension score of early and final SRL is compared as presented in the Figure 1 as follows.

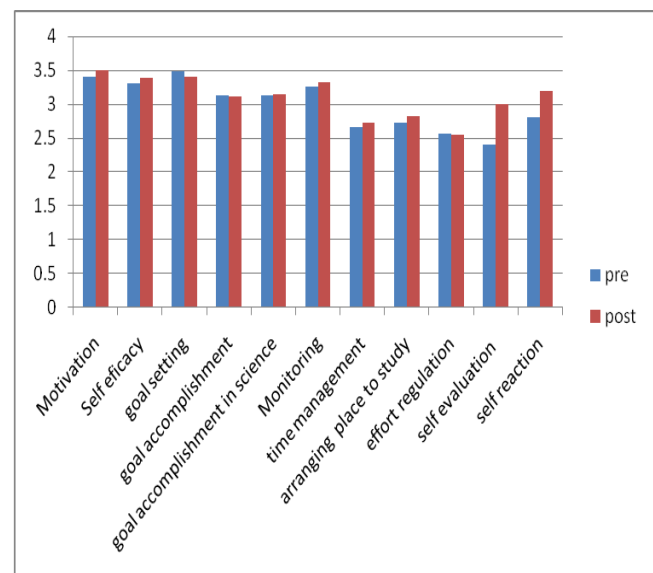


Fig.1. The means of SRL sub dimension before and after online tutorial

After doing t test between each sub dimension of SRL, we got 2 sub dimension which differ significantly, namely self evaluation and self reaction. The analysis show that the mean self-evaluation and self-reactions of pre and post SRL differ significantly ($p < 0.05$, at $\alpha = 5\%$), whereas post SRL is higher than pre SRL.

Significant differences and improvements of the average self-reflection score of the SRL is relevant to the performance demonstrated by the students at the time of SRL training particularly at self-reflection training while online tutorial. Of the 20 students of online tutorials, fifty percent of students did self-reflection on a weekly basis, 35% of students do self-reflection every 2 weeks or more, while another 15% of students did not do self-reflection during the training. In this training, students were asked to assess themselves in terms of what material had been mastered, what material had not been mastered, why the material was not mastered and efforts were made to overcome the problem. From their answers, it could be seen that most of the students (80%) stated not yet mastered all the material taught every week, and they are determined to repeat the material independently.

Self-reflection is part of the metacognitive aspect of the process by which a person thinks and controls the cognitive process³¹. A person uses his cognitive process to think about the thinking process. This is conducted because students can choose and use appropriate strategies to improve future performance. As a person who has the ability to reflect. He will be able to consider what he has done and what he will do in his time of data.

Furthermore, analysis of gaining the average score of early and final SRL results of the N-gain analysis show that N gain SRL (N=0.31) is at medium category. When we searched per individual, 5% of students who increased their SRL in high categories, 45% of students who increased their SRL in the category of moderate learning, and 50% of students who increased their SRL in the low category.

The Pretest and post test score of students

Result of t-test showed that as that overall pretest score differed significantly with posttest score ($p < 0.05$, at $\alpha = 5\%$), where posttest were higher than pretest. The results of this study are in line with the results of previous studies, in which the learning outcomes increase with increasing student self-reliance^{29,32-34}. The results of this study were also relevant to the opinion of experts who stated that self-reguated learning has an important contribution to academic success⁷. Students with higher SRL skills perform better than students with lower SRL skills⁷, not only on face to face learning format but also on online learning³⁵.

The results of the N-gain test analysis showed that the gain score is at medium level, where 2 students got increased learning outcomes into the high category, fourteen students got the moderate category, and 4 students got the low category. Eight weeks of SRL training is suspected to be a stimulant of increasing learning outcomes. The mind mapping strategy, the compilation of questions and answers, and the discussion

supposedly helped to increase the learning achievement achieved by the students. From twenty students of online tutorial participants, 95% of students involved in the learning process, whether it is doing tutorial tasks and mind mapping tasks, the preparation of questions and answers, and discussions. The increase in the average of SRL score is thought to be influenced by an increase in learning independence that has occurred which is the impact of the learning self-learning training that is successful learners who can manage, control and evaluate themselves.

5. CONCLUSIONS

Based on the results of research and discussion it can be concluded that training strategies metacognitive and cognitive SRL can improve students' SRL and learning outcomes of distance students in the course of Anatomy and Human Physiology. Training on metacognitive strategies that include self-reflection training and evaluation can enhance students' self-reliance, while cognitive strategy training that includes mind mapping, questions and answers and discussion can improve student learning outcomes.

REFERENCES

- [1] D.N. Perkins. Technology meets constructivism: Do they make a marriage? In T.M. Duffy & D.H. Jonassen (Eds.). *Constructivism and the technology of instruction: A conversation* (1992) 45 – 55. Hillsdale, Nj: Lawrence Erlbaum Associates.
- [2] O. Kirmizi. Investigating self regulated learning habits of distance education students. *Journal of History Culture and Art Research*, 2 (2) (2013) 161 - 174
- [3] G.M. Moore & G. Kearsley. *Distance Education: a System View of Online Learning*. Third Edition. (2012). Belmont, CA: Wadsworth, Cengage Learning
- [4] M. Simonson, S. Smaldino, M. Albright & S. Zvacek *Teaching and Learning at a Distance: Foundation of Distance Education*. Fifth edition. (2012). Boston : Allyn & Bacon
- [5] Ambar Puspitasari dan Samsul Islam. Kesiapan belajar mandiri mahasiswa dan calon potensial mahasiswa pada pendidikan jarak jauh Indonesia. *Jurnal Pendidikan Terbuka dan Jarak Jauh*, 4 (1) (2003).
- [6] U. Rahayu dan Ari Widodo. The profile of biologi education students, Universitas Terbuka, on self regulated learning. *Proceeding of Mathematics and Science Education*, Bandung, Indonesia. (2015)
- [7] B.J. Zimmerman and D.H. Schunk. *Self regulated learning and academic achievement: theoretical perspectives*. Hisdale, N.J: Erbaum (2001).
- [8] P.R. Pintrich, The role of goal orientation in self regulated learning. In M. Boekarts, P. Pintrich, & M. Zeidner (Eds.) *Handbook of self regulation* (p. 451-502). (2000). San Diego, CA: Academic Press
- [9] D.F. Kauffman. Self regulated learning in web based environments: instructional tools designed to facilitate cognitive strategy use, metacognitive processing, and motivational beliefs. *J. Educational Computing Research*, 30 (1 & 2) (2004) 139 -161.
- [10] T. Shuy. *Self-Regulated Learning*. Teaching excellence in adult literacy Center fact sheet no. 3. American Institute for Research. (2010)
- [11] F.A. Rowe dan J.A. Rafferti. *Instructional Design Intervention for supporting self-regulated learning: enhancing academic*

- outcomes in postsecondary E-learning Environments. *Merlot Journal of Online Learning and Teaching*, 9 (4) (2013) 590-601.
- [12] B.J. Zimmerman. Attaining self regulation: a social cognitive perspective. In M. Boekarts, P. Pintrich, & M. Zeidner (Eds.) *Handbook of self regulation* (2005) 13-39 San Diego, CA: Academic Press.
- [13] Schunk, D.H. *Learning Theories. An educational Perspectives. Teori-teori Pembelajaran: Perspektif Pendidikan*. Edisi keenam. (2012). Yogyakarta: Pustaka Belajar.
- [14] M. Moore. Self-directed learning and distance education. *Journal of distance education*, 1(1) (1986) 7-24.
- [15] M.S. Andrade, and E.L. Bunker. Language learning from a distance: A new mode for success. *Distance Education*, 30 (1) (2009) 47-61
- [16] B.J. Zimmerman and D.H. Schunk. *Self regulated learning and academic achievement: theoretical perspectives*. (2001). Hisdale, N.J: Erbaum
- [17] J. Taylor. *Fifth Generation Distance Education*. Higher Education Series. Report No 40. (2001). Department of Education, training and youth affairs.
- [18] I. E. Allen and J. Seaman (Class Differences: Online Education in the United States. (2010). Babson Survey Research Group, 30. Retrieved from <http://eric.ed.gov/?id=ED529952%5Cnhttp://files.eric.ed.gov/fulltext/ED529952.pdf>
- [19] D. F. Kauffman, R. Zhao, & Y. S. Yang. Effects of online note taking formats and self-monitoring prompts on learning from online text: Using technology to enhance self-regulated learning. *Contemporary Educational Psychology*, 36(4)(2011) 313–322.
- [20] Puspitasari, The effect of learning strategy intervention and study time management intervention on students' self regulated learning, achievement, and course completion in a distance education learning environment. (2012). Dissertation. The Florida State University College Education
- [21] G. Cheng and J. Chau. Exploring the relationship between students' self-regulated learning ability and their ePortfolio achievement. *Internet and Higher Education*, 17(1) (2013) 9–15.
- [22] P.R. Pintrich, C. Wolters, & G. Baxter. Assessing metacognition and self regulatory learning. In G. Shraw & J.C. Impara (Eds.) *Issues in the measurement of metacognition* (2000) 43-97. Lincoln NE: Buros Institute of Mental Measurements.
- [23] T. Buzan and S. Abbott. *The ultimate book of mind maps: unlock your creativity, boost your memory, change your life*. (2005). Thornsons, London.
- [24] A. J. Mento, P. Martinelli, and R. M. Jones. Mind Mapping in Executive Education: Applications and Outcomes. *Journal of Management Development*. 18(4) (1999) 390-416.
- [25] Y. Zhao. The use of a constructivist teaching model in environmental science at Beijing Normal University. *The China Papers* (2)(2003)78-83. Retrieved from <http://science.uniserve.edu.au/pubs/china/vol2/yezhaopdf>
- [26] U. Rahayu, T. Darmayanti, A. Widodo, S. Redjeki. The development of CERDAS learning strategy guide for science education students of distance education. *Journal of Physics: Conference Series* 912 (2017)
- [27] U. Rahayu, , A. Widodo, S. Redjeki. The Effect of Self Regulated learning Trough online tutorials integrating learning strategy in improving the independence and academic achievement of Biology Education students. *USEJ* 6(2)(217) 1552-1560.
- [28] R. Hake. Interactive engagement vs traditional methods: A six thousand student survey of mechanism test data for introductory physics course. *American Journal of Physic*, 66(1) (1998) 64-74.
- [29] A.-M. Cazan, Teaching Self Regulated Learning Strategies for Psychology Students. *Procedia - Social and Behavioral Sciences*, 78 (2013) 743–747.
- [30] D.H. Schunk and P.A. Ertmer. Self regulation and academic learning: Self efficacy enhancing intervention. Dalam M. Boekarts, P. Pintrich, & M. Zeidner (Eds.) *Handbook of self regulation* (2000). 631-646) San Diego, CA: Academic Press.
- [31] M.W. Matlin, *Cognitive Psychology*. Seventh edition. Hoboken, NJ: John Willey and Sons. (2009).
- [32] C. Peng. Self regulated learning behavior of college students of science and their academic achievement. *Physics Procedia*, 33(2012)1446 -1450.
- [33] M. Radovan. The relation between distance student motivation their use of learning strategies, and academic success. *The Turkish Online Journal of Educational Technology*, 10 (1) (2011).
- [34] B. Eilam, M. Zeidner, & I. Aharon. Student consciousness, self regulated learning, and science achievement: an explorative field study. *Psychology in the School*, 46 (5) (2009) 420-432
- [35] Barnard, Paton & Lan. Online self regulatory learning behaviors as a mediator in the relationship between online course perception with achievement. *International Review of Research in Open and Distance Learning*, 9 (2) (2008).