

Self-Regulated Learning Mathematics of Students in Secondary School

Budi Yanto^{1, a)} and Heri Retnawati^{2, b)}

¹*Postgraduate Program of Mathematics Education, Yogyakarta State University*

²*Mathematics Department, Faculty of Mathematics and Natural Science, Yogyakarta State University
Jl Kolombo No 1, Karangmalang, Depok, Sleman, Yogyakarta, Indonesia*

^{a)}Corresponding author: budi.yanto2016@student.uny.ac.id

^{b)}retnawati_heriuny@uny.ac.id

Abstract. The development of 21st century information technology enables students to access information related to subject learning easily and quickly. This study was conducted to describe the student self-regulated learning of mathematics in secondary school and to compare the difference of scores between male and female students. The sample of a study from 93 students consisting of 45 female students and 48 male students in secondary school and ages 13 - 15 years old. This study uses a descriptive qualitative approach. In this describes the self-regulated learning on aspects of self-awareness, setting goals and learning strategies, and self-reflection. The results showed that the self-regulated learning of mathematics in general is still relatively low. The average score of self-regulated learning mathematics student of female is higher than male students.

Keywords: self-regulated learning, learning mathematics

INTRODUCTION

Mathematics is a universal science that has an important role in developing the human mind in various disciplines and underpinning the development of modern technology [1]. The development of 21st century information technology enables students to access information related to their subjects easily and quickly. Many students have devices that can access and use the internet. The ease of accessing the internet and many websites providing content related to mathematics subjects should thus be able to impact students' learning activities. This availability allows students to search for mathematical information relevant to the material they have and being learned as well as future learning so that enable students to learn independently anytime and anywhere by accessing a particular of website.

Students' activities in learning mathematics not only rely heavily on the information from teachers, but also, importantly, students have to build their own learning concepts and principles. This is where self-regulated learning takes place. Self-regulated learning is important to build students' learning concepts and principles [2]. Furthermore, self-regulated learning is the nature and ability of students to conduct active learning activities, driven by their motive to master and build competence derived from their previous background knowledge or competence [3]. The self-regulated learning can bring students to think actively and creatively for being able to resolve the issue without or with little help from the teacher [4]. With the self-regulated learning students do not only build knowledge in school but also after leaving school. Therefore, [5] says that one of the factors that influence success in learning is the independence of learning.

Self-regulation began to be published in the journal on social psychology and personality in the 1980s, in the United States as and in Europe, while in the 1990s, self-regulation significances were also published in educational, organizational, clinical and psychological health journals discussing aspects of the general concept

of self-regulation, including self-regulated learning, self-control and self-management [6]. Moreover, [7] state that self-regulated learning has some relevance to the concept of metacognition, self-directed learning, self-organized learning, personalized learning and self-regulated personalized learning

Self-regulated learning is an active and constructive learning process in which learners set goals for their learning and then try to monitor, organize, and control their cognition, motivation and behavior, guided and constrained by the goals and conditions in its environment [8]. Self-regulated learning is a process in which individuals take initiative, with or without the help of others, in diagnosing their learning needs, formulating objectives, identifying human and material resources, selecting and applying appropriate learning strategies, and evaluating learning outcomes [9]. Likewise, [10] states that Self-Regulated Learning (SRL) is an active process in which students set goals that lead their learning, trying to monitor, regulate and control their cognition, and behavior to achieve it. [11] states that self-regulated learning is a proactive process that students use to acquire academic skills, such as setting goals, choosing and implementing strategies, and monitoring their own effectiveness. In addition, [12] self-regulated learning is a process in which individuals take their own initiative, with or without the help of others, to diagnose learning needs, formulate learning objectives, identify learning resources, select and define learning strategy approaches and evaluate learning outcomes achieved. The last, self-regulated learning is the ability to monitor, regulate, control the aspects of cognition, and self-behavior in learning, while students have independence if the initiative to learn, have the ability to self-determination, diagnose the needs of learning, creative and initiative in utilizing learning resources and choose learning strategies and monitor, organize, and control learning [13]

The self-regulated learning is described as a cyclical process involving several things: goal setting, process monitoring and learning strategies, and self-evaluation [14] Furthermore, self-regulated learning consists of four stages: (1) evaluation and self-monitoring, (2) goal setting and strategic planning, (3) implementation and monitoring of strategies, (4) monitoring of strategic outcomes [15]. In short, in this study, self-regulated learning is a conscious condition or initiative of an individual to learn, set learning goals and methods or learning strategies and to do reflection or self-evaluation in learning activities. Self-awareness is related to the state of an individual without the influence of others to perform an activity. Learning objectives relate to the final direction of learning activities both short-term and long-term goals. Learning strategies relate to the way students use to achieve their expected goals and how students learn. Self-reflection is concerned with how students evaluate themselves to achieve the intended goal.

METHODOLOGY

This study uses a descriptive qualitative approach. This study aims to collect information on students' mathematics of self-regulated learning. Samples were 93 junior high school students who were between 13 and 15 years old. They consisted of 45 females and 48 males. This study was conducted in Lampung province of Indonesia. This study used a questionnaire. The questionnaire consisted of 20 questions put in five likert-scale as follows: always, often, seldom, ever, and never. This questionnaire instrument passed the validity test of expert judgment and reliability test of Alfa Cronchbach. To compare students' self-regulated learning based on gender, this study used t-test. The interval criteria of self-regulated learning based on adaptation of [16] as in table 1.

Table 1. Interval Criteria of Student Mathematic Self-regulated learning

Interval	Score	Criteria
$X > \bar{X}_i + 1,8 \times sb_i$	$X > 84$	Very High
$\bar{X}_i + 0,6 \times sb_i < X \leq \bar{X}_i + 1,8 \times sb_i$	$68 < X \leq 84$	High
$\bar{X}_i - 0,6 \times sb_i < X \leq \bar{X}_i + 0,6 \times sb_i$	$52 < X \leq 68$	Sufficient
$\bar{X}_i - 1,8 \times sb_i < X \leq \bar{X}_i - 0,6 \times sb_i$	$36 < X \leq 52$	Low
$X \leq \bar{X}_i - 1,8 \times sb_i$	$X \leq 36$	Very Low

FINDING AND DISCUSSION

The results showed that the average score of students' self-regulated learning was 62.24, the minimum score 41, the maximum score of 87 and the deviation standard was 9.77. Based on the criteria of self-regulated learning on table 1, students' self-regulated learning is still on the "Sufficient" category. Furthermore, students' mathematics self-regulated learning was differentiated based on gender. The result of the average score of students' mathematics self-regulated learning was 60, the minimum score was 41, the maximum score was 87 and

the deviation standard was 8.17. The result of the average score of students' mathematics self-regulated learning was 60, the minimum score was 50, the maximum score was 81 and the deviation standard was 10.6. Furthermore, the self-regulated learning score of student's mathematics based on aspects can be seen in table 2.

Table 2. Students' mathematic self-regulated learning's score based on aspect (%)

Aspect	Items	Gender			
		Male	Criteria	Female	Criteria
Self-awareness	1, 4, 7, 10, 13, 16, 19	62.44	Sufficient	66.85	Sufficient
Setting Goals and Strategies	2, 5, 8, 11, 14, 17, 20	64.88	Sufficient	57.38	Sufficient
Self-reflection	3, 6, 9, 12, 15, 18	60.2	Sufficient	61.48	Sufficient

Besides, students' mathematic self-regulated learning' score based on statements is in the following.

Table 3. Students' mathematic self-regulated learning score (%)

No	Aspect	Gender			
		Male	Criteria	Female	Criteria
1	Prior to get learning mathematic at school, I prepare by myself my mathematics learning stuffs at home.	83.3	High	93.3	Very High
2	I learn mathematics to get a good score.	76.3	High	80.9	High
3	When having a test, I check my answers on the answer sheet test prior to submit the sheet to the teacher.	69.2	High	68	Sufficient
4	I do my individual assignment independently.	69.2	High	62.7	Sufficient
5	I ask my friends certain learning topics that I do not understand.	77.1	High	80	High
6	If there is additional course on mathematic, I join the course.	37.5	Low	44	Low
7	I ignore my teachers' explanation in teaching learning process.	66.7	Sufficient	67.1	Sufficient
8	If I got difficulties in such topic of mathematics in my assignment, I will solve my difficulties by finding out information or explanation of that topic on website, blog, or youtube.	46.3	Low	56.9	Sufficient
9	If there is a free time of learning in school, I use my time to have a chat with my friends.	51.7	Low	49.3	Low
10	I answer the exercise questions in my mathematic books without any order.	36.7	Low	38.7	Low
11	I access websites related to mathematics subject.	46.7	Low	53.3	Sufficient
12	If my mathematic score is low, I will learn harder.	81.8	High	77.9	High
13	At the time of mathematic learning activities in the classroom, I prefer to keep silent when I do not understand the topic.	60.8	Sufficient	68.8	High
14	If this day I learn mathematic subject, I will learn again this subject at home.	54.2	Sufficient	51.6	Low
15	I do not learn mathematics at home.	70.4	High	70.7	Sufficient
16	I learn mathematics because it is important.	70	High	76.4	Sufficient
17	I learn mathematics outside the school learning with my friends.	36.3	Low	55.1	Sufficient
18	I submit my mathematics assignments without thinking the results.	54.6	Sufficient	55.1	Sufficient
19	I learn mathematics when only I face mathematics test.	50.8	Low	60.9	Sufficient
20	I make mathematics formula notes to help memorize the formula.	65	Sufficient	76.4	High

This study reveals that the mathematics self-regulated learning of female students is higher than that of male students. It is also in accordance with [17,18, 19, 20] that the mathematics self-regulated learning higher female than male students. The students' self-self-regulated learning score on the aspects of self-awareness and self-reflection of female students is higher than that of male students. This result is consistent with the finding of [21] which showed that there was a difference in students 'self-regulated learning score and female students' self-self-regulated learning score higher than male students. Besides, in determining the goals and learning strategies, male students predominate female students. Moreover, the average score on the aspect of setting student learning goals and strategies, male students is higher than female students. This is consistent with [22] which reveals that the average score of male students' learning strategies is higher than that of female students. While the average score on the self-reflection aspects of female students is higher than male students. It is also in accordance with [23] that the average score of female students' reflection or evaluation is higher than that of male students.

Based on aspects of learning strategies, the average score of female students is higher than male students in their smartphone use. But the use of smartphones in accessing education-related is still relatively low while the use of smartphones for accessing social media is still relatively high. The use of smartphones by students is still limited to social media and play games only. The use of smartphones in students related to math lessons is still low or very low. The students, in fact, still have not seen many videos of mathematics learning, whereas math learning videos can help students in understanding the learning topics. Furthermore, the students do not have much access to blogs that provide problems and discussion of mathematics. Based on a survey conducted by [24], the use of internet-related education is still relatively low, but the use of internet-related for social media purposes is still relatively high.

CONCLUSION

The results showed that the self-regulated learning of students' mathematics learning in general was relatively sufficient. This study reveals that the mathematics self-regulated learning of female students is higher than that of male students. The average score of students on self-awareness and self-reflection in female students is higher than that of male students. However, the average score on the aspect of setting goals and learning strategies of female students is lower than male students.

Seeing the low condition of self-regulated learning especially in this digital era, educators should facilitate and encourage students to be more active in improving their self-regulated learning. One of the efforts is to facilitate self-regulated learning with technology is the use of the internet. There are many websites providing content related to math lessons that are more interesting and diverse. More students access the internet related math lessons then the information that students get will be more as well. The need for innovation in learning to use the internet network. The use of the internet can be used as a supplement or additional students in learning and learning that is not optimal in class. By accessing the internet students can study independently at any time and using smartphones or devices that can access the Internet. So that students no longer make the teacher as the main source of information but students can explore information related to mathematics lessons by accessing the internet

REFERENCE

1. Amiluddin, Risnawati and Sugiman, "Pengaruh Problem Posing dan PBL Terhadap Prestasi Belajar, dan Motivasi Belajar Mahasiswa Pendidikan Matematika", *Jurnal Riset Pendidikan Matematika*, vol. 3, no. 1, pp. 100 – 108. 2016.
2. Y. Purnamasari, "Pengaruh Model Pembelajaran Kooperatif Tipe Teams Games Tournament (TGT) Terhadap Kemandirian Belajar dan Peningkatan Kemampuan Penalaran dan Koneksi Matematik Peserta Didik SMPN 1 Kota Tasikmalaya", *Jurnal Pendidikan dan Keguruan*, vol 1, no 1, pp. 1 – 11, 2014.
3. P. N. Aini, and A. Taman, "Pengaruh Kemandirian Belajar dan Lingkungan Belajar Siswa Terhadap Prestasi Belajar Akuntansi Siswa Kelas XI IPS SMA Negeri 1 Sewon Bantul", *Jurnal Pendidikan Akuntansi Indonesia*, vol. 10, no. 1, pp. 48 – 65, 2012.
4. R. Azka and R. H. Santoso, "Pengembangan Perangkat Pembelajaran Kalkulus untuk Mencapai Ketuntasan dan Kemandirian Belajar Siswa" *Jurnal Riset Pendidikan Matematika*, vol. 2, no. 1 pp. 78 – 91, 2015.

5. H. Retnawati, "Proving Content Validity of Self-Regulated Learning Scale (The Comparison of Aiken Index and Expanded Gregory Index)", *Journal Research and Evaluation in Education*, vol. 2, no. 2, pp. 155 – 164, 2016.
6. M. Boekaerts, P. R. Pintrich and M. Zeidner, "Self-Regulation an Introductory Overview", in *Handbook of Self Regulated*, edited by M. Boekaerts, P. R. Pintrich and M. Zeidner (Academic Press, New York. 2000), pp. 1 – 10.
7. J. Beishuizen and K. Steffens, "A Conceptual Framework for Research on Self-Regulated Learning", In *Self-Regulated Learning in Technology Enhanced Learning Environments*, edited by R. Carneiro et al, Technology Enhanced Learning Sense Publisher, vol 5, pp, 3 – 19, 2011.
8. P. R. Pintrich, "The Role of Goal Orientation in Self-Regulated Learning", in *Handbook of Self Regulated*, edited by M. Boekaerts, P. R. Pintrich and M. Zeidner (Academic Press, New York, 2000), pp: 451 – 502.
9. K. Knowles, "Self-directed learning: A guide for learners and teachers" in *Investigating Self-Regulated Learning Habits of Distance Education Students*, edited by O. Kirmizi, *Journal of History Culture and Art Research*, vol. 2, pp. 161 – 174, 2013.
10. Valle, et al, "Self-Regulated Profiles and Academic Achievement. *Journal Psicothema*", vol. 2, no. 4, pp. 724 – 731, 2008.
11. D. Eliserio, "Self-Regulated Learning and Mathematics Achievement in a Fourth Grade Classroom", Master of Education Program Theses, Department of Education Dordt College, 2012.
12. I. Tahar and Enceng, "Hubungan Kemandirian Belajar dan Hasil Belajar pada Pendidikan Jarak Jauh", *Jurnal Pendidikan Terbuka dan Jarak Jauh*, vol. 7, no. 2, pp. 91 – 101, 2006.
13. Lestari and Yudhanegara, "Penelitian Pendidikan Matematika: Panduan Praktis Menyusun Skripsi, Tesis, dan Laporan Penelitian dengan Pendekatan Kuantitatif, Kualitatif dan Kombinasi disertai dengan Model Pembelajaran dan Kemampuan Matematis" (PT Refika Aditama, Bandung, 2015), pp, 94.
14. J. Beishuizen and K. Steffens, "A Conceptual Framework for Research on Self-Regulated Learning", In *Self-Regulated Learning in Technology Enhanced Learning Environments*, edited by R. Carneiro et al, Technology Enhanced Learning Sense Publisher, vol 5, pp, 3 – 19, 2011.
15. B. J. Zimmerman, "A Social Cognitive View of Self-Regulated Academic Learning", *Journal Of Educational. Psychology*, vol. 81, no. 3, pp. 329 – 339, 1989.
16. P. E. Widoyoko, "Evaluasi Program Pembelajaran: Panduan Praktis Bagi Pendidik dan Calon Pendidik" (Pustaka Pelajar, Yogyakarta, 2009), pp. 238.
17. B. J. Zimmerman and M. M. Pons, "Student Differences in Self-Regulated Learning: Relating Grade, Sex, and Giftedness to Self-Efficacy and Strategy Use", *Journal of Educational Psychology*, vol. 82, no. 1, pp. 51 – 59, 1990.
18. K. M. Justice and C. Zhu, "Self regulated learning among student of Montains of the Moon University", *Conference Paper in South Africa International Conference on Education at Pretoria*, pp. 1 – 13, 2015.
19. S. A. Sardareh, M. R. M. Saad and R. Boroomand, "Self-Regulated Learning Strategies (SRLS) and Academic Achievement in Pre-university EFL learners", *Journal California Linguistic Notes*, vol. 37, no. 1, pp.1 – 35, 2012.
20. E. Bozpolat, "Investigation of the Self-Regulated Learning Strategies of Students from the Faculty of Education Using Ordinal Logistic Regression Analysis", *Educational Sciences: Theory & Practice*, vol. 16, no. 1, pp. 301 – 318, 2016.
21. Sugiyarni., Rosmawati, and Z. Saam, "The Differences of Students Self Regulated Learning of Male and Female at SMPN 14 Pekanbaru in 2016/2017", *Jurnal Online Mahasiswa (JOM) Universitas Riau*, pp. 1 – 11, 2017.
22. O. Lawanto and W. H. Goodridge, "Self-Regulated Learning Strategies of Grades 9-12 Students in Design Project: Performance and Gender Perspectives", *American Society for Engineering Education*, pp. 1 – 14, 2012.
23. O. Lawanto and W. H. Goodridge, "Self-Regulated Learning Strategies of Grades 9-12 Students in Design Project: Performance and Gender Perspectives", *American Society for Engineering Education*, pp. 1 – 14, 2012.
24. Asosiasi Penyelenggara Jasa Internet Indonesia, "Survei Penetrasi dan Perilaku Pengguna Internet Indonesia", *Asosiasi Penyelenggara Jasa Internet Indonesia (APJII)*, pp. 1 – 34, 2016.

