Relationship of self-regulated learning with student learning outcomes in chemistry study

S Fazriah¹, D Irwandi¹, D Fairusi¹
¹Department of Chemistry Education, Faculty of Tarbiyah and Teacher Training, UIN Syarif Hidayatullah Jakarta, Indonesia
E-mail: dedi.irwandi.yuskar@uinjkt.ac.id

Abstract. This study aims to analyze the connection between self-regulated learning and students' chemistry outcomes by large and by gender. The study used correlational technique with a quantitative methodology. Sampling was done using random sampling technique. The quantity of exploration tests was 408 student respondents comprising of 159 males and 249 females. The data collection technique was carried out by using a questionnaire adapted from the Motivated Strategies for Learning Questioner (MSLQ) and documentation study. Data were analyzed using the Spearman Rank correlation analysis technique. The results was obtained that the correlation coefficient in general was 0.272. Meanwhile, the correlation coefficient value based on gender was 0.248 for male students and 0.284 for female students. This shows that there was a positive relationship between self-regulated learning with student chemistry learning outcomes and female students have a higher self-regulated learning relationship with chemistry learning outcomes than male students.

1. Introduction
The effectiveness of implementing educational programs can be identified by evaluating teaching and learning activities, one of which is through the assessment of student learning outcomes. According to Sudjana, learning outcomes are the various abilities students have after going through the learning process [1]. Assessment of student learning outcomes is something that is very important and strategic in teaching and learning activities. With the assessment of learning outcomes, it can be seen how much success students have mastered the competencies or material that has been taught by the teacher [2].

Various studies and discussions, both regarding educational philosophy, learning theory, teaching methods, material classification, and various other matters, directly or indirectly aim to encourage students to achieve good learning outcomes. One of the subjects with low learning outcomes is science. Data from Program for International Student Assessment (PISA) in 2015 which conducted a survey to test the academic performance of school children aged 15 years regarding science, reading, and mathematics, it shows that Indonesia is ranked 62 out of 70 countries in the field assessment science [3]. This shows that the achievement of learning outcomes, especially in science education in Indonesia, is still relatively low.

One of the subjects of science is chemistry. The achievement of students' chemistry learning outcomes is also still relatively low. High school national examination data in 2017 for chemistry subjects show an average value of 50.52 [4]. Achievement of low learning outcomes in chemistry can be caused by numerous things. One of the reasons is that chemistry is considered a difficult subject by some students. According to Ristiyani and Bahriah, chemistry lessons in high school contain concepts that are very hard for students to understand regarding chemical reactions and estimations as well as...
Another factor that causes the low achievement of learning outcomes in chemistry is the absence of active role of students. Pribula said that students were not really actively involved in the chemistry learning process, so many students only listened passively to the teacher’s explanation when in class [6]. This shows that the students' low attention to play an active role in the learning process, even though basically in teaching and learning activities, students are both subjects and objects in learning activities.

There are many factors that influence the achievement of student learning outcomes. In general, the factors that influence student learning are categorized into two, namely internal factors and external factors [7]. Meanwhile, according to Clemons research, learning outcomes are a complex relationship between individual abilities, self-perception, assessment of tasks, expectations of success, cognitive strategies and self-regulation, gender, parenting style, socioeconomic status, performance, and individual attitudes towards school [8]. This shows the existence of both internal and external factors that influence student learning outcomes, causing individual differences in the achievement of learning outcomes, one of which is self-regulated learning.

Self-regulated learning is the student's ability to participate actively in the learning process, both metacognitive, motivational, and behavioral to achieve learning goals [9]. Meanwhile, according to Santrock, self-regulated learning is generating and monitoring one's own thoughts, feelings, and behaviors to achieve a goal. These goals can be academic goals (increasing reading comprehension, being a good writer, learning multiplication, asking relevant questions), or socio-emotional goals (controlling anger, learning to get along with peers) [10]. According to Wangid self-regulated learning is a learning activity that occurs on the thoughts of students who have the ability to arouse themselves so that they can affect their thoughts, feelings, plans and behavior to achieve goals [11]. The same thing that is emphasized in the above definition is the reference to the success of achieving goals in learning, mainly determined by students themselves, and not by the educator. Self-regulated learning can be said as a regulatory action, in which students use the strategy to achieve academic goals. Thus it is indicated that the strategies applied by students in achieving good learning outcomes may vary, but students who in their learning efforts meet certain characteristics can be said to have self-regulated learning.

The ability of students to plan, monitor and overcome obstacles during the learning process can be seen in the form of self-regulated learning abilities. However, nowadays many students find it difficult to plan lessons. This can be due to various reasons, such as the habit of students staying up late, watching YouTube, playing online games and traveling for hours. Savira and Suharsono emphasized that a student's failure to achieve success could be due to the student not being able to manage study time well or it could be said that he had poor self-regulated learning [12]. According to Parvin, Vahid, and Gholamreza, the relationship between self-regulated learning and learning outcomes is very important in learning. Therefore, education must help students to be aware of their thinking, and have strategies and motivation to achieve learning goals [13].

The perspective of self-regulated learning has profound implications for how teachers interact with students and how schools should be. Self-regulated learning shifts the focus of educational analysis from students' learning abilities and the environment as passive objects to students' personal processes and responses designed to improve their ability and their environment to learn [14]. Self-regulated learning emphasizes the active role of students in the learning process. The ability of students to plan, monitor, and overcome obstacles during the learning process can be seen in the form of self-regulated learning abilities.

Based on some of these opinions, the term self-regulated learning can be defined as an active process of directing individuals to convert their mental abilities into academic skills in the form of activities or strategies that are oriented towards achieving learning goals. Students who have self-regulated learning will generate and monitor their own thoughts, feelings, and behaviors to achieve these learning goals. According to Pintrich, there are three aspects to self-regulated learning, each of which consists of several learning strategies [15]. First, cognitive learning strategies that is used to remember and understand the subject matter. This aspect consists of strategies, namely rehearsal, elaboration, and organization. Second, metacognitive and self-regulatory strategies on how to plan,
monitor, and manage various things during the process of achieving goals. This aspect consists of critical thinking and metacognitive self-regulation. Third, resource management strategies on how students manage and control their learning environment. Strategies included in this aspect is time and study environment, effort regulation, peer learning, and help-seeking.

Beside it, one of the topics discussed in the world of education is gender issues. Gender problems result in differences in thought patterns and attitudes between male and female students [16]. Sugiyarni, Rosmawati, and Saam also revealed the same thing that gender differences cause differences in physiological and psychological aspects of learning. So that male and female students certainly have many differences in studying subjects [17]. This indicates that there are differences in self-regulated learning between the two.

Therefore, the formulation of the problem in this study : "Is there a relationship of self-regulated learning with student learning outcomes in chemical subjects?" and "Do differences in the sex of students affect the relationship between self-regulated learning and student learning outcomes in chemistry subjects?". The purpose of this research is to determine whether there is a relationship between self-regulated learning and student learning outcomes in chemistry subjects and to find out whether or not there are differences in the relationship between self-regulated learning and student learning outcomes in chemistry subjects based on gender.

2. Research Methods
The research was conducted in 3 public high schools in Tangerang Selatan City. The research time is in the even semester of the 2017/2018 school year in early January to mid-April 2018. Sampling was carried out using simple random sampling technique. The number of research samples were 408 students of class X and XI IPA (15-16 years old students), consisting of 159 male students and 249 female students.

The research instrument used to measure students’ self-regulated learning was a questionnaire adapted from the Motivated Strategies for Learning Questioner (MSLQ) developed by Pintrich, Smith, Garcia, and Mc.Keachie [18]. The questionnaire consisted of 50 statements consisting of three aspects, namely cognitive strategies, metacognitive and self-regulatory strategies, and resource management strategies.

The data obtained from the questionnaire were self-regulated learning scores and data on student learning outcomes obtained from the even midterm test scores for the 2017/2018 school year. The data is processed to obtain a description of the data in the form of the average value (mean), middle value (median), and the highest and lowest scores. Before the test the hypothesis, it is necessary prerequisite test analysis of the form normality and homogeneity test with a significance level of 5%. The homogeneity test used the Kolmogorov- Smirnov test, while the homogeneity test used the Levene Statistics homogeneity test. After the prerequisite test, then the hypothesis test was carried out. Hypothesis testing used in this study using the Spearman Rank correlation test. The Spearman Rank correlation test is intended to determine the relationship between the two variables with a minimal ordinal scale, so that the scores can be sorted according to their size statistically. The entire test process is calculated using the IBM SPSS Statistics 22.

In categorizing the data, the categories used consisted of very good, good, good enough, and poor. As a reference for data categorization, the following score intervals were used [19]:

| Self-Regulated Learning Scores | Chemistry Learning Outcomes | Category       |
|-------------------------------|-----------------------------|----------------|
| >200                          | >75                         | Very Good      |
| 150 s.d 200                   | 50 s.d 75                   | Good           |
| 100 s.d <150                  | 25 s.d <50                  | Good Enough    |
| <100                          | <25                         | Poor           |
3. Result and Discussion
From the results of the research conducted, data were obtained in the form of students’ self-regulated learning scores from the MSLQ questionnaire and data on student learning outcomes. The data on student self-regulated learning scores can be seen in Table 1.

| Data               | Whole | Male | Women |
|--------------------|-------|------|-------|
| Number of Respondents | 408   | 159  | 249   |
| Highest Score      | 247   | 247  | 223   |
| Lowest Score       | 77    | 77   | 78    |
| Average            | 171.58| 168.69| 173.43|
| Median             | 171   | 169  | 175   |
| Mode               | 170   | 161  | 170   |

In Table 2 the average score of students’ self-regulated learning overall is 171.58. This shows that the average student self-regulated learning as a whole is in the good category. Novakova and Varkova showed that the essence of high self-regulation is when they realize that everyone is an regulator of themselves [20]. This means that in general students have realized the importance of autonomy and personal responsibility in learning activities. Students who have great self-regulated learning perceive learning as something that must be arranged accordingly and perceive each obstacle as a challenge and look for ways to solve it. Students with good self-regulated learning also evaluate each learning activity and find factors that support the achievement of learning outcomes [21]. According to Bol and Garner, basically each student has the ability to organize himself in the learning process, but the quality and quantity as well as the level of success differ from one student to another [22].

Based on the data in table 2, the mean score of self-regulated learning for male students was 168.69 and female students were 173.43. It can be said that the mean score of male students’ self-regulated learning is lower than that of female students. The finding that the mean score for female students’ self-regulated learning was higher than that of male students, indicates a different tendency to use strategies when studying. Female students use learning strategies better than male students. This is in line with the results of research by Saad, Tek, and Baharom that female students have higher self-regulated learning than male students in science subjects [23]. According to Studenska, male students have more difficulties in terms of planning, organizing, and implementation of learning, as well as organize motivation and emotional [24].

The difference in the level of self-regulated learning between female students and male students can be influenced by environmental factors. According to Saputra, Alhadi, Supriyanto, Wiretna, and Baqiyatussolihat, the environment created by female students provides an opportunity for them to provide mutual reinforcement and attention to the development of the level of self-regulated learning, so that environmental conditions are increasingly strengthening to improve self-regulated learning [25]. While male students are known to have an attachment or sense of solidarity with their group, they are more susceptible to adverse influence from peers [26]. This attachment can have a negative impact, one of which is the decrease in the quality of their self-regulated learning, for example academic procrastination, which is the habit of procrastinating on assignments due to other things. This is in line with research conducted by Safa’ati, Halim, and Iliyati which shows that student self-regulated learning and peer conformity have an effect on academic procrastination [27]. Conformity is a change in perceptions and behavior by individuals as a form of adjustment to group norms so that they can be accepted as part of the group [28].

In addition to the data on self-regulated learning scores, data were also obtained in the form of student chemistry learning outcomes. Student chemistry learning outcomes data can be seen in Table 3.
The Spearman Rank

Table 3. Descriptive statistics of student chemistry learning outcomes scores.

| Data                | Whole  | Male  | Women |
|---------------------|--------|-------|-------|
| Number of Respondents | 408    | 159   | 249   |
| Highest Score       | 100    | 100   | 96    |
| Lowest Score        | 17     | 20    | 17    |
| Average             | 63.52  | 58.74 | 66.58 |
| Median              | 66     | 58    | 71    |
| Mode                | 82     | 50    | 84    |

Table 3 showed that the learning outcomes of 408 students have an average of 63.52. The highest score was 100 and the lowest score was 17. Based on Table 2, the results of the calculation of the average value of the students' chemistry learning outcomes showed that the students' chemistry learning outcomes were in the good category. It is in line with students' self-regulated learning which shows a good category too. This means that self-regulated learning is directly proportional to learning outcomes. Good self-regulated learning will produce good learning outcomes. This is in line with Peng's study which showed that student learning outcomes are closely related to strategies in self-regulated learning, especially cognitive strategies. Apart from motivational factors, the involvement of cognitive strategies also has a great influence on student learning success [29].

In terms of gender, showed that the average value of the learning outcomes of male and female students was different. The average learning outcomes of male students were 58.74 and female students were 66.58. Thus the learning outcomes of female students are higher than male students. The difference in the average chemistry learning outcomes between male and female students can be caused by several factors, one of which is student self-regulated learning. Female students have a higher learning outcome being better able to optimize the self-regulated learning. For example, the cognitive and metacognitive strategies used. The results of research conducted by Peklaj and Pecjak found that female students knew more about self-regulation, used more metacognitive strategies and were more intrinsically motivated and used more strategies to control their learning efforts [30]. It is reinforced by a similar study conducted by Peklaj and Pecjak that female students repeat lessons more often than male students and they do more practice questions as homework, using more elaboration and organizational strategies during learning. They also better manage their learning strategies such as planning, monitoring, and evaluating themselves in learning [31].

To determine whether there is a relationship between self-regulated learning and student chemistry learning outcomes, it is necessary to test a hypothesis in the form of a test using the Spearman Rank correlation test. Before testing the hypothesis, a prerequisite analysis test was carried out in the form of a normality and homogeneity test. Data from the normality test and homogeneity test with a significance level of 5% ($\alpha = 0.05$) can be found in Table 4.

Table 4. Normality and homogeneity test.

| Data                        | Type of Test | Sig. value |
|-----------------------------|--------------|------------|
|                             |              | Whole | Male | Women |
| Scores of self-regulated    | Normality test | 0.06 | 0.20 | 0.07 |
| learning                    | Homogeneity Test | -    | 0.32 |       |
| Student learning outcomes   | Normality test | 0.00 | 0.00 | 0.00 |
|                             | Homogeneity Test | -    | 0.37 |       |

Based on Table 4, it is known that the data on student self-regulated learning scores, both as a whole and based on gender, are normally distributed and homogeneous, because the resulting significant value is greater than 0.05. This shows that the sample comes from a normal population and has the same variation. While the data on student learning outcomes both as a whole and based on gender are not normally distributed, but both are homogeneous. Because there are data that are not normally distributed, it means that the data do not meet the requirements for the parametric test. Thus,
to test the hypothesis carried out using the nonparametric correlation test, namely the Spearman rank correlation test. Correlation test data can be seen in Table 5.

| Data                  | Whole | Male | Women |
|-----------------------|-------|------|-------|
| Sig. (1-tailed)       | 0.00  | 0.00 | 0.00  |
| Correlation coefficient | 0.27  | 0.24 | 0.28  |

Based on Table 5, it is known that the coefficient value is 0.27 with a sig. 1-tailed = 0.00 <0.05. A significant value smaller than 0.05 indicated that there was a significant positive relationship between the self-regulated learning variables and the students’ chemistry learning outcomes in general in the study. The trust value showed a low relationship but still in a positive direction, so it can be said that the higher the students ‘self-regulated learning, the higher the students' chemistry learning outcomes. These results were supported by research by Alotaibi, et al which found that self-regulated learning has a positive and significant correlation with student learning outcomes. The characteristics of self-regulated learning allow students to achieve higher learning outcomes. Students who have effective self-learning can associate their thoughts and actions with their own learning environment and can plan, choose strategies, and read their learning environment to gain the best possible knowledge [32]. This is also supported by Daniela's research that independent learning has a strong influence on student learning outcomes. Student learning outcomes increase if the student is aware of reading and organizing himself, is able to plan and shows persistence in achieving success [33].

The results of hypothesis testing for data based on gender showed that the correlation coefficient value for male students is 0.24 with a Sig. 1 tailed = 0.00 0 <0.05 (significant alpha), which means that there is a significant positive relationship between the self-regulated learning variable and the male students’ chemistry learning outcomes. Meanwhile, the correlation coefficient value for female students was 0.28 with a Sig. 1 tailed = 0.000 <0.05 (significant alpha), which means that there was a significant positive relationship between the self-regulated learning variables and the chemistry learning outcomes of female students. The correlation coefficient of 0.24 for male students and 0.28 for female students indicates that both of them have a low relationship between self-regulated learning and student chemistry learning outcomes. The correlation coefficient value between self-regulated learning and chemistry learning outcomes of female students was higher than that of male students. This implied that there was a connection where if female students have better self-regulated learning, the female students' chemistry learning outcomes will likewise be higher.

According to Bidjerano, female students are much better at using rehearsal strategies, organization, metacognition, time management skills, and elaboration [34]. Another study conducted by DiBenedetto and Bembenutty stated that there is a pattern of sex differences in self-regulated learning, especially in the aspect of seeking assistance. Female students consistently seek help more often than male students when they encounter difficulties in lessons. Female students are more active in seeking help from various sources, such as teachers and classmates to help them overcome difficulties encountered during the learning process [35].

Based on these findings, teachers should be aware of the differences in self-regulated learning between men and women, and working to solve it for example to change the way of teaching. In the school environment, strategies in self-regulated learning can be systematically taught and integrated into the curriculum. The curriculum should explicitly encourage students to think, organize their thinking processes, and develop students’ self-regulated learning and their learning effectiveness so that it can improve students’ abilities for the better. Teachers must focus on creating awareness in students about the importance of having self-regulated learning, for example by providing training on independent learning strategies, especially for male students.
4. Conclusion
From the results of the research and discussion previously described, it can be concluded that:
1. There is a positive relationship between self-regulated learning and students' chemistry learning outcomes.
2. There is a positive relationship between self-regulated learning and student chemistry learning outcomes based on gender. Female students have a higher relationship between self-regulated learning and chemistry learning outcomes than male students.

Acknowledgements
We would like to thank you to International Conference of Education in Moslem Society (ICEMS) 2020 FITK UIN Syarif Hidayatullah Jakarta for publication support.

References
[1] Sudjana N 2010 Penilaian Hasil Proses Belajar Mengajar (Bandung, PT Remaja Rosdakarya) p 22
[2] Kunandar 2014 Penilaian Autentik (Penilaian Hasil Belajar Peserta Didik Berdasarkan Kurikulum 2013) (Jakarta: PT Rajagrafindo Persada) p 61
[3] Organisation for Economic Co-operation and Development (OECD) 2016 Result From PISA 2015-Indonesia. Country Note- Programme for International Student Assessment 1-8.
[4] Puspendik Kemdikbud 2017 Laporan Hasil Ujian Nasional https://hasilun.pusdikbud.kemdikbud.go.id 24 January 2018
[5] Ristiyani E and Bahriah E S 2016 Analisis Kesulitan Belajar Kimia Siswa di SMAN X Kota Tangerang Selatan Jurnal Penelitian dan Pembelajaran IPA 2 (1) 18-29.
[6] Ashadi 2009 Learning Difficulties for Middle School Students [Online] https://library.uns.ac.id/kesuangan-belajar-kimia-bagi-siswa-sekolah-menengah/ 24 January 2018
[7] Slameto 2010 Belajar dan Faktor-faktor yang Mempengaruhinya (Jakarta: Rineka Cipta) p 54
[8] Clemons T L 2008 Underachieving Gifted Students: A Social Cognitive Model The National Research Center on the Gifted and Talented 1-84
[9] Zimmerman B J 1989 A Social Cognitive View of Self-Regulated Academic Learning Journal of Educational Psychology 329--39
[10] Santrock J W 2005 Adolescence (New York: McGraw-Hill) p 143
[11] Wangid M N 2004 Improving Student Achievement Through Self-Regulated Learning Educational Horizons 1 1-19
[12] Savira F and Suharsono Y 2013 Self Regulated Learning (SRL) dengan Prokratinasi Akademik Pada Siswa Akselerasi Jurnal Ilmiah Psikologi Terapan 1(1) 66-75
[13] Parvin K, Vahid M T and Gholamreza S 2015 Relationship Between Self-Regulated Learning Strategies with Academic Achievement: A Meta-Analysis Recent Advances on Educational Technologies 78-80
[14] Zimmerman B J 1990 Self-Regulated Learning and Academic Achievement: An Overview Educational Psychologist 25(1) 3-17
[15] Pintrich P R 1999 The Role of Motivation in Promoting and Sustaining Self-Regulated Learning International Journal of Educational Research 459-470
[16] Ingalhalikar M, Smith A, Parker D, Satterwhite T, Elliott M, Ruparel K, et al 2014 Sex Differences in the Structural Connectome of the Human Brain Proceedings of the Academy of Sciences 111 823—28
[17] Sugiyarni, Rosmawati, and Saam Z 2017 Differences in Independent Learning for Boys and Girls at SMP Negeri 14 Pekanbaru TP, 2016/2017 Journal of Guidance and Counseling Study Program, Faculty of Teacher Training and Education, Riau University 1-11
[18] Pintrich, P, Smith D, Garcia T, and McKeachie W 1991 A Manual for the Use of the Motivated
Strategies for Learning Questionnaire National Center for Research to Improve Postsecondary Teaching and Learning (NCRPI TAL) 1-76

[19] Sya’ban A 2005 Teknik Analisis Data Penelitian. Pelatihan Metode Penelitian Universitas Prof. Dr. Hamka 1-69

[20] Novakova R K and Vavrova S 2015 Self-Regulation of Behaviour in The Context of Peer Pressure and Risk Behaviour Social and Behavioral Sciences 171 158 – 65

[21] Tjalla A and Sofiah E 2015 Effect of Methods of Learning and Self Regulated Learning toward Outcomes of Learning Social Studies Journal of Education and Practice 6(23) 15-20

[22] Bol L and Garner J 2011 Challenges in Supporting Self-Regulation in Distance Education Environments J Comput High Education 23 104—23

[23] Saad M I, Tek O E, and Baharom S 2011 Self-Regulated Learning: Gender Differences In Motivation and Learning Strategies Among Malaysian Science Students Journal of the Sultan Idris University of Education Malaysia 1-6

[24] Studenska, A. (2011). Educational Level, Gender and Foreign Language Learning Self-Regulation Difficulty. Procedia - Social and Behavioral Sciences 29: 1349-1358

[25] Saputra W N, Alhadi S, Supriyanto A, Wiretna C D, and Baqiyatussolihat B 2018 Differences in Self-Regulated Learning of Vocational High School Students Based on Gender Journal of Guidance and Counseling Studies 3 (3) 131-138

[26] McCoy S, Dimler L, Samuels D, and Natsuaki M 2019 Adolescent Susceptibility to Deviant Peer Pressure: Does Gender Matter? Adolescent Res Rev 59-71

[27] Safa'ati E, Halim M I, and Iliyati Z 2017 The Role of Self-Regulation and Peer Conformity with Academic Procrastination of Muria Kudus University Students Proceedings of the National Conference of Indonesian Psychology Young Researchers 2(1) 75-84

[28] Suminar E, and Meiyuntari T 2014 Self-Concept, Conformity and Consumptive Behavior in Adolescents Indonesian Psychology Journal 145-152

[29] Peng C 2012 Self-Regulated Learning Behavior of College Students of Science and Their Academic Achievement International Conference on Medical Physics and Biomedical Engineering 33 1446—50

[30] Peklaj C, and Pečjak S 2002 Differences In Students, Self-Regulated Learning According to Their Achievement and Sex Studia Psychologica 44 29-44

[31] Peklaj C, and Pečjak S 2011 Emotions, Motivation and Self-Regulation in Boys ’ and Girls’ Learning Mathematics Horizons of Psychology 20 (3) 33-58

[32] Alotaibi K, Tohmaz R, and Jabak O 2017 The Relationship Between Self-Regulated Learning and Academic Achievement for a Sample of Community College Students at King Saud University Education Journal 6(1) 28-37

[33] Daniela P 2015 The Relationship Between Self-Regulation, Motivation And Performance At Secondary School Students Procedia-Social and Behavioral Sciences 191 2549—53

[34] Bidjerano T 2005 Gender Differences in Self-Regulated Learning Paper Annual Meeting of the Northeastern Educational Research Association 1-8

[35] DiBenedetto M, and Bembenuity H 2011 Within the Pipeline: Self-regulated Learning and Academic Achievement among College Students in Science Courses Self-regulation in College Science Courses 1-10