Gender differences on students’ self-regulated learning in mathematics

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Abstract. Self-regulated learning (SRL) is a process carried out by students on their awareness in formulating goals, determining strategies, motivating and monitoring themselves in learning and evaluating the results of their learning. This study aims to describe the SRL of junior high school students in learning mathematics from gender differences. The method used in this research is quantitative descriptive. The study was conducted at SMPN 1 Pecangaan. The sample used was 73 8th-grade students, consisting of 35 male students and 38 female students. The data were retrieved by using a questionnaire with Likert scale. The results of this study indicated that there were differences in SRL between male and female students in learning mathematics based on independent t-test (0.001<0.05). Female students were superior in each indicator of all aspects of SRL, namely metacognition, motivation, and active involvement in learning activities. It can be concluded that female students have better SRL in learning mathematics compared to male students.

1. Introduction
Learning is the main activity in education. Through learning, various kinds of skills are taught and given to students. One important learning is mathematics learning. Mathematics learning trains and accustoms students to be logical, critical, systematic, effective, and efficient in solving problems [1]. Students are trained to be able to reason and think well through learning mathematics.

In fact, in Indonesia mathematics is one of the most difficult subjects for students. This can be seen from the low score of mathematics tests when compared with other subjects. Based on data from the Ministry of Education [2], for the last 5 years from 2015 to 2019, the national examination mathematics score of junior high school students was always the lowest compared to Bahasa Indonesia, English, and natural science subjects. Although mathematics is difficult, it does not mean that there are no students who are successful in mathematics. There are students who can learn mathematics well.

The main factor influencing student success in mathematics is self-regulated learning (SRL). SRL has a positive effect on academic results [3,4]. Students who have a good SRL will also get good learning achievement. This is in line with Samo’s findings, that increasing SRL contributed to improving students' mathematical abilities [5].

SRL is not a mental ability or an academic performance skill but a process of self-direction used by students in turning their mental abilities into academic skills [6]. SRL is an effective learning theory that includes motivation, goal setting, behavior, and metacognitive strategies, in an iterative process that uses self-monitoring and feedback to modify the application of this learning behavior [7]. SRL allows students to construct knowledge by identifying their learning goals, organizing their learning process and evaluating their performance against goals [8].
Forms of personally directed learning such as discovery learning, handpicked reading, or searching for information from electronic sources are important matters in SRL. In addition, there are things that are no less important in the form of social learning, such as seeking help from peers, parents, and teachers. With the help of the social environment, students can overcome problems experienced in connection with learning.

According to Zimmerman, in general SRL consists of 3 main aspects including metacognition, motivation, and active behavior in their learning. In the case of metacognitive processes, the SRL includes planning, setting goals, organizing, monitoring themselves, and evaluating themselves at various points during the acquisition process. These processes allow them to be self-aware, knowledgeable, and assertive in their approach to learning.

Motivation in SRL is where students feel high self-efficacy, self-attribution, and are interested in intrinsic tasks. From a motivational point of view, an independent individual realizes his competence, paying attention to his high confidence in himself. Highly motivated individuals begin learning by displaying extraordinary effort and perseverance while studying. Motivational beliefs are the nature of strategic skills that often determine student success in school.

Behavior in SRL is the student's effort to choose, structure, and create an environment that optimizes learning. They ask for advice or seek information related places where they feel most comfortable learning. Based on several opinions that have been described, aspects and indicators used in this research are explained in Table 1 as follows.

| Aspect          | Indicators                                                                 |
|-----------------|----------------------------------------------------------------------------|
| Metacognition   | Planning a learning strategy                                               |
|                 | Setting learning goals                                                     |
|                 | Organizing themselves in learning                                          |
|                 | Monitoring themselves in learning                                          |
|                 | Evaluating themselves in learning                                          |
| Motivation      | Conducting an assessment of the abilities, competencies, and strengths possessed by themselves |
|                 | Using the abilities, competencies, and strengths possessed in learning      |
| Behavior        | Choosing an environment that optimizes learning                            |
|                 | Structuring the environment that optimizes learning                        |
|                 | Creating the environment that optimizes learning                          |

Each student has a different level of SRL. When viewed from gender differences, male and female students have differences in organizing themselves in learning. Studies suggest that the effect of gender on SRL is influenced by culture, subjects, and age. Samuelsson and Samuelsson in their study stated that male students considered mathematics important, exceeding the assumptions of female students. On the other hand, research from Pajares states that in the SRL of female students show more setting goals and planning strategies, and they take notes and monitor themselves more often than male students.

Based on these explanations, this study aims to describe the SRL of junior high school students in learning mathematics. The SRL is seen from gender differences between male and female students. Furthermore, it will be analyzed in each aspect of SRL between male and female students.

2. Method
This research is quantitative descriptive research. This research aims to describe the differences in SRL of male and female students in learning mathematics. T-test is used to see if there is a difference between male and female students on SRL. Furthermore, it was analyzed in each aspect of SRL by looking at the mean scores between SRL male and female students.
Pecangaan. The subject of this research is 8th-grade students. Subjects were selected by random sampling, consisting of 73 students with 35 male students and 38 female students. Data was taken using a questionnaire with Likert scale. The choice of the questionnaire is 5 frequency scales ranging from always to never. The questionnaire consisted of 43 questions.

3. Results and discussion

3.1 Statistic test (t-test)
First, it was tested whether there was a difference between SRL of male students and female students in learning mathematics. The testing used independent sample t-test with SPSS software version 23. The test was conducted after the normality test was performed as a prerequisite test, the following results were obtained in Table 2.

| Gender | Shapiro-Wilk Statistic | Df | Sig. |
|--------|------------------------|----|------|
| Male   | 0.961                  | 35 | 0.239|
| Female | 0.952                  | 38 | 0.101|

Table 2 shows that the Shapiro-Wilk value of male students is 0.239 and female students is 0.101. Both of them are more than 0.05, which means SRL data from male and female students are normally distributed. After knowing the data from SRL male and female students are normally distributed, t-tests can be done. The results of the t-test can be seen in Table 3.

|                  | t-test for Equality of Means |
|------------------|-----------------------------|
|                  | Df  | Sig (2-tailed) | Mean Differe |
| Equal variances  |     |               |              |
| assumed          | 71  | 0.001         | -16.589      |
| Equal variances  |     |               |              |
| not assumed      | 66.888 | 0.002       | -16.589      |

Based on Table 3, we can see the value of Sig (2-tailed) of 0.001. This value is less than 0.05 which means there were differences in SRL of male and female students in learning mathematics. Furthermore, we also found out how SRL between male and female students analyzed based on every aspect and indicators of SRL between male and female students.

3.2 Analyze of SRL between male and female students
There were differences on SRL male and female students in learning mathematics. It will be seen in each aspect of the SRL of male and female students and analyze it based on the average value obtained by both. In the metacognition aspect of SRL, there are 5 indicators. The average score of male and female students can be observed in the following table.

| Indicators                           | Male Students | Female Students |
|--------------------------------------|---------------|-----------------|
| Planning a learning strategy         | 3.35          | 3.83            |
| Setting learning goals               | 3.64          | 3.94            |
| Organizing themselves in learning    | 3.28          | 3.62            |
| Monitoring themselves in learning    | 3.34          | 3.70            |
| Evaluating themselves in learning    | 3.33          | 3.91            |

Table 4 shows that in the aspect of metacognition female students are superior in each indicator. Significantly, female students are better at planning strategies, setting goals, managing themselves,
monitoring themselves and evaluating themselves in learning mathematics. Based on these indicators it can be seen if female students are able to plan and choose better learning strategies. Female students are able to better organize themselves in learning such as overcoming boredom in learning. Female students also do more self-evaluation in their learning. These things indicate those female students are more self-aware and more assertive in their approach to learning compared to male students. However, this does not indicate that male students are bad in the aspect of metacognition. From the Table 4, it can be observed that the average score of male students is at a moderate level.

In accordance with Zimmerman and Martinez-Pons, in their research state that female students tend to use self-monitoring, setting learning goals, planning their learning more often than male students [15]. Other research by Tseng in language learning states that female students have better control in the use of strategies than male students. In particular, female students are superior to male students in terms of controlling emotions, awareness, and boredom [16].

The next aspect of SRL is the motivation aspect. The average score of male and female students in this aspect can be observed in Table 5.

| Table 5. Results of SRL on Motivation Aspect |
|---------------------------------------------|
| Indicators                                  | Male Students | Female Students |
| Conducting an assessment of the abilities, competencies, and strengths possessed by themselves | 3.26          | 3.62          |
| Using the abilities, competencies, and strengths possessed in learning | 3.57          | 3.63          |

Table 5 shows that in the aspect of motivation female students are superior to male students. When seen in the first indicator that is assessing the abilities, competencies, and strengths possessed, female students have better self-efficacy than male students. Female students have higher confidence in their abilities and have higher intrinsic interest. Based on the second indicator that is using abilities, competencies and strengths possessed in learning, female students are able to use their abilities and advantages to be more diligent and try more in learning mathematics compared to male students.

This is certainly in contrast to previous research conducted by Skaalvik and Skaalvik which states that male students have a higher intrinsic motivation than female students in learning mathematics [17]. More comprehensive findings were found in Skaalvik's research, stating that in learning mathematics male students are superior in self-conception, performance expectations, intrinsic motivation, and self-enhancing ego orientation. Based on this it can be seen that cultural and environmental differences are certainly very influential on motivation in learning mathematics.

The last aspect of SRL is behavioral aspect. In this aspect, the average score of male and female students can be observed in Table 6.

| Table 6. Results of SRL on behavioral aspect |
|---------------------------------------------|
| Indicators                                  | Male Students | Female Students |
| Choosing an environment that optimizes learning | 4.05          | 4.37          |
| Structuring the environment that optimizes learning | 4.01          | 4.34          |
| Creating the environment that optimizes learning | 3.91          | 4.51          |

From Table 6, it can be observed that female students excel compared to male students in the behavioral aspect. When viewed from indicators on behavioral aspects such as choosing, structuring, and creating an optimal learning environment, both male and female students alike have good awareness because both have a fairly high average. However, compared to male students, female students are more able to choose a comfortable place to study, arrange their learning places to be optimal, or create an optimal learning environment. This is in accordance with Zimmerman and Martinez-Pons which states that female students are superior to male students in environmental management [15].
Overall, of the three aspects of SRL that are metacognition, motivation, and behavior in learning, female students are better than male students in learning mathematics. Research from Temi Bidjerano states that female students surpass male students in their ability to use practice, organization, metacognition, time management skills, elaboration, and effort [18]. Bezina [19] said that female students use SRL strategies more than male students. Even so, there is also a contra in his research findings which state that male students are more intrinsically motivated in learning mathematics, compared to female students. These differences occur because the culture, disciplines studied and the environment is very diverse. Therefore there is still plenty of room available for future research related to this self-regulated learning.

4. Conclusion
There were differences in SRL between male and female students in learning mathematics in junior high school. Overall female students excel in all aspects of SRL (metacognition, motivation, and behavior in learning). In each indicator on each aspect, female students had a higher rate than male. It can be said that the SRL of female students in learning mathematics is better than male students in junior high school.

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