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Students' Self-Regulated Learning based on Gender and Disciplinary Differences during Online Learning

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Abstract

Online learning during the pandemic impacts the student's learning behavior. It altered how students learn and manage their time, including at the higher education level. Thus, self-regulated learning, particularly for undergraduate students, should be examined. This research aimed to explore (1) the difference between self-regulated learning based on the gender perspective, (2) the difference between self-regulated learning based on the difference disciplinary, and (3) the correlation between students' achievement and students' self-regulated learning. The research participants were categorized into female and male students in the Department of Biology Education. The participants were also categorized into two study programs, i.e.: biology and biology education. Twenty-four questions were administered online to 124 students. The instrument consisted of six subscales, 1) goal setting, 2) environment structuring, 3) task strategies, 4) time management, 5) help-seeking, and 6) self-evaluation. The research data were analyzed descriptively to compare the average mean in gender and disciplinary differences. Then, the relationship between students' self-regulated learning towards gender and the relationship between students' self-regulated learning toward the study program were analyzed using an independent sample T-test. In addition, correlation analysis was conducted to find the correlation between students' self-regulated learning and learning achievement. The results showed that there was no significant relationship between gender differences in self-regulated learning ($p = 0.665$) and study programs ($p = 0.008$). The research results also showed a correlation ($r = 0.0270$) between students' achievement and self-regulated learning.

INTRODUCTION

The pandemic has changed learning methods, particularly in higher education. Based on the Indonesian Government Regulation No. 21 of 2020 on large-scale social restrictions to accelerate the management of coronavirus disease 2019 (COVID-19), the Indonesian government implemented restrictions on community activities in mid-2020, including learning activities conducted on campus. Learning activities that are initially carried out, i.e.: face-to-face, are changed to online. In addition, laboratory works that are part of the curriculum are also changed to group or individual projects. As a result, restrictions on on-campus activities cause changes in students' learning behavior. One of the changes in students' learning behavior is a change in students' learning autonomy. Since the online learning environment is characterized by autonomy, self-regulation becomes a critical factor for success in online learning (Barnard et al., 2009).

Self-regulated learning is defined as action and process directed at acquiring information or skills involving agency, purpose, and instrumentality perception by students (Zimmerman, 1990). Self-regulated learning involves activating and sustaining cognition, behaviors, and emotion to achieve learning purposes (Pintrich, 2000). Moreover, self-regulated learning is cyclical and multi-component (Zimmerman & Risemberg, 1997). Three related phases of self-regulated learning are forethought, performance, and self-reflection (Zimmerman, 2000). Self-regulated learning also emphasizes specific skills, such as setting purposes for learning, applying strategies to achieve learning goals, monitoring performance, and restructuring the learning environment to achieve purposes (Zimmerman & Schunk, 2021).

Self-regulated learning also encompasses three phases, namely preparation, performance, and appraisal. In online learning, self-regulated is

very crucial as a requirement for successful on online education (Ifenthaler, 2013). In self-regulated learning, particularly in the preparation phase, it is essential to identify external factors affecting the learning process (Hong et al., 2021). In the performance phase, self-regulated learning influences how students perform task strategies and monitor their learning. Moreover, in the appraisal phase, seeking help, evaluating, and adjusting to their learning progress is vital. A previous study identified the strategies of the self-regulated learning framework for K-12 students learning in online environments to support remote learning with online and digital tools during the COVID-19 pandemic. This research indicated that asking students to think about how they learn online, offering pacing support, keeping an eye on engagement, and assisting families are some of the primary techniques that have evolved from earlier studies (Carter et al., 2020).

Three characteristics describe self-regulated students. First, self-regulated students use self-regulated strategies. Students with self-regulated learning approach the assignment with confidence, diligence, and resourcefulness. They also actively finding information and alternative solutions to solve problems. Self-regulated students are characterized by awareness of strategies regulation between regulatory process and learning outcomes. These strategies are used to achieve academic goals. Metacognitive, motivational, and behavioral strategies are utilized in learning. Second, self-regulated students monitor the effectiveness of their learning methods or strategies or get self-oriented feedback. They also react to the feedback differently and changing their self-perception to their behavior, such as altering their learning strategies. Third, self-regulated students have an independent motivational process. They have various strategies and responses and know how and why they use them (Zimmerman, 1990).

In recent years, a lot of studies have examined SRL in an online environment (Tsai et al., 2013). Previously, reviewed studies examine the relationship between academic success in online learning and self-regulated learning strategies such as time management, effort regulation, metacognition, critical thinking, rehearsal, organization, help-seeking, and peer learning. These study indicate that four strategies, such as metacognition, time management, effort regulation, and critical thinking, are correlated with online academic success. In contrast, other strategies are not significantly related (Broadbent & Poon, 2015)**.** Another research also discovered that self-regulated learning effectively supports the students in online learning by using several supports, such as feedback and integrated support systems (Wong et al., 2019).

Furthermore, the relationship between gender and self-regulated learning has been conducted. Here, a previous study revealed that females perform better than males in three dimensions of students' online self-regulated learning in high school settings (Liu et al., 2021). Another study on undergraduate students stated that female students are better at using rehearsal, organization, metacognition, time management skills, elaboration, and effort. However, this study also discussed that there is no statistically different between females and males in terms of help-seeking, studying with peers, and critical thinking skills (Bidjerano, 2005).

Self-regulated learning is also very substantial in teacher education programs. Previous studies showed science teacher programs utilizing self-regulated learning skills are necessary because teachers are expected to have a leading role in implementing such skills. This research found that students' self-regulated information could be used as a recommendation in designing the curriculum of teacher education programs and give strategies to reinforce learning. Most importantly, it also strengthen the self-efficacy of future teacher**s** (Arcoverde et al., 2022)**.**

However, during the COVID-19 pandemic, pre-service biology teachers face different teaching and learning situations. The study of students' self-regulated learning on pre-service biology teachers, particularly during distance learning in the COVID-19 pandemic, is still limited, so the profile of self-regulated in that certain condition should be measured. Therefore, this research addresses three problems: 1) the difference in self-regulated learning based on the gender perspective (male and female students), 2) the difference of self-regulated learning based on the difference disciplinary (biology and biology education students), and 3) the correlation between students' achievement and students' self-regulated learning.

RESEARCH METHOD

The instrument used was the Online Self-regulated Learning Questionnaire (Barnard et al., 2009). The questionnaire consisted of a 24-item scale with a 5-point Likert response format. The response had values ranging from strongly agree (5) to strongly disagree (1). The questionnaire covered six sub-scales in self-regulated learning, including 1) goal setting (5 questions), 2) environment structuring (4 questions), 3) task strategies (4 questions), 4) time management (3 questions), 5) help-seeking (4 questions), and 6) self-evaluation (4 questions). The instrument is explained in Table 1.

The research participants were 153 students of the Department of Biology Education. Research participants were categorized into female and male students. The participants were also distributed into two study programs, i.e.: biology and biology education. From these participants, 134 students (87.58%) were female, and 19 students (12.42%) were male. According to the study program, 72 students (47.06%) were from the biology education study program, and 81 students (52.94%) were from the biology study program.

This research analyzed data descriptively to compare the average mean in gender and disciplinary differences. The relationship between students' self-regulated learning and gender was analyzed using an independent sample T-test. The similar analysis was also used in determining the relationship between students' self-regulated learning and the study program. In addition, correlation analysis was conducted to find the correlation between students' self-regulated learning and learning achievement. Prior to the analysis, the data is checked for homogeneity and normality.

Table 1. Online self-regulated learning questionnaire.

No	Item	Sub scale
1	I set standards for my assignments in online courses.	Goal setting
2	I set short-term (daily or weekly) and long-term goals (monthly or for the semester).	
3	I keep a high standard for my learning in my online courses.	
4	I set goals to help me manage time to study for my online courses.	
5	I don't compromise the quality of my work because it is online.	
6	I choose the location where I study to avoid too much distraction.	Environment structuring
7	I find a comfortable place to study.	
8	I know where I can study most efficiently for online courses.	
9	I choose a time with few distractions for studying for my online courses.	
10	I try to take more thorough notes for my online courses because notes are even more important for learning online than in a regular classroom.	Task strategies
11	I read aloud instructional materials posted online to overcome distractions.	
12	I prepare my questions before joining the chat room and discussion.	
13	I work on extra problems in my online courses in addition to the assigned ones to master the course content.	
14	I allocate extra studying time for my online courses because I know it is time demanding.	Time Management
15	I try to schedule the same time every day or every week to study for my online courses, and I observe the schedule.	
16	Although we don't have to attend daily classes, I still try to distribute my studying time evenly across days.	
17	I find someone knowledgeable in course content so that I can consult with him or her when I need help.	Help-seeking
18	I share my problems with my classmates online so we know what we are struggling with and how to solve our problems.	
19	If needed, I try to meet my classmates face-to-face.	
20	I am persistent in getting help from the teacher through email.	
21	I summarize my learning in online courses to examine my understanding of what I have learned.	Self Evaluation
22	When studying for an online course, I ask myself many questions about the course material.	
23	I communicate with my classmates to find out how I am doing in my online classes.	
24	I communicate with my classmates to find out what I am learning that is different from what they are learning.	

RESULTS AND DISCUSSION

Various learning media are used during online learning. Students in both biology and biology education participated in lectures conducted using video conference applications. They are also accompanied by Learning Management System (LMS), provided in every course. During online learning, students are also assigned different types of assignments, whether individual or group projects, such as essays, group discussions, or group projects. Those projects encourage students to perform self-regulated learning, including goal

setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation.

This study measures the relationship between students' self-regulated learning and gender. Data were analyzed descriptively to compare the average mean in gender differences. Independent sample t-tests are conducted to examine the relationship between students' self-regulated learning and gender. Before the analysis was carried out, the data were tested for normality and homogeneity. The normality and homogeneity tests show that the data are normally distributed dan homogenous ($p > 0.05$). The result is shown in Tables 2 and 3.

Table 2. The descriptive statistics of self-regulated learning with respect to gender.

	Average	
	Female	**Male**
Mean	3.596	3.548
Std. Deviation	0.443	0.449
Minimum	2.667	2.500
Maximum	4.958	4.458

From Table 2, the mean and standard deviation for the male students are 3.548 and 0.499, whereas, for female students, the mean and standard are 3.596, and 0.443. The result shows that, in average, the self-regulated learning of female students is higher than male students.

Table 3. The relationship between students' self-regulated learning toward gender

Independent Sample T-Tests			
	t	**df**	**p**
Average	0.434	151	0.665

Note. Students' t-test.

Based on Table 3, the result also shows that there are no significant relationship between students' self-regulated learning and gender, with $t = 0.434$ and $p = 0.665 > 0.001$. This result indicates that there is no significant difference in self-regulated learning in online learning between female and male students. However, the differences between subscales is presented in Table 4.

Table 4. The average of self-regulated learning subscale based on gender differences.

Subscale	**Female**	**Male**
Goal setting	3.560	3.558
Environmental structuring	4.200	4.224
Task strategies	3.276	3.171
Time management	3.398	3.316
Help-seeking	3.334	3.395
Self-evaluation	3.769	3.566

Table 4 shows that female students are better at goal setting, task strategies, time management, and self-evaluation. Meanwhile, male students are higher in environmental structuring and help-seeking. This result follows the previous research that females tend to have higher self-regulated during online learning (Chumbley et al., 2018). In a certain circumstance, such as the pandemic, female students are better at self-regulated learning (Wijaya et al., 2020). Female students tend to perform better in rehearsal, organization, metacognition, time management skills, elaboration, and effort (Bidjerano, 2005). However, female and male students have high environmental structuring.

Furthermore, this research also measures the relationship between students' self-regulated learning and study programs. The data are analyzed descriptively to compare the average mean in disciplinary difference. The relationship between students' self-regulated learning and the study program is analyzed using an independent sample T-test. Before the analysis, the data are tested for normality and homogeneity. The normality and homogeneity tests show that the data is normally distributed dan homogenous ($p > 0.05$). The results are presented in Tables 5 and 6.

Table 5. The descriptive statistic of self-regulated learning to disciplinary difference.

	Average	
	Biology	**Biology Education**
Mean	3.500	3.692
Std. Deviation	0.455	0.421
Minimum	2.500	2.958
Maximum	4.958	4.667

The results show that, in the Biology study program, the mean and standard deviation are 3.5000 and 0.455, whereas for the biology education study program, the mean is 3.692, and the standard deviation is 0.421. The average self-regulated learning of biology education students is higher than in biology students**.**

Table 6. The relationship between students' self-regulated learning and study program.

Independent Samples T-Test			
	t	**df**	**p**
Average	-2.691	151	0.008

Note. Student's t-test.

The result also shows that there is no significant relationship between students' self-regulated learning towards the study program, with t = -2.691 and p =0.008 > p = 0.001. This result indicates that there is no significant difference in self-regulated learning in distance learning between biology and biology education students. However, the differences between subscales is presented in table 7.

Table 7. The average of self-regulated learning subscale based on study program differences.

Subscale	Biology	Biology Education
Goal setting	3.506	3.619
Environmental structuring	4.173	4.236
Task strategies	3.139	3.403
Time management	3.239	3.556
Help-seeking	3.192	3.510
Self-evaluation	3.685	3.809

Table 7 describes the differences between self-regulated learning between biology and biology education students. Based on Table 7, biology education students are slightly higher in goal setting, environmental structuring, task strategies, time management, help-seeking, and self-evaluation. Several reasons can be used to explain students' self-regulated learning for both disciplines, which is not significantly different. Both study program students participate in a similar learning environment equipped with learning aids. Students are encouraged to actively seek information independently and cooperatively within the group. In addition, teachers also give students opportunities to interact with other teammates or students. This gives them a chance to improve their self-regulated learning during online learning. Students' experience in participating in online learning also affects their self-regulated learning. Students with previous online learning experiences tend to have more effective learning strategies when taking online courses and have a higher motivation to participate in online courses (Wang et al., 2013). Therefore, self-regulation is a dispositional variable responsible for various contexts of self-regulatory behaviors (Diehl et al., 2006).

This research also measures the correlation between students' self-regulated learning and the student's achievement. Before the analysis, the data are tested for normality and homogeneity. The normality and homogeneity tests show that the data are normally distributed and homogenous. The result shows a correlation between students' achievement and self-regulated learning. Table 8 shows the correlation between students' achievement and self-regulated learning. The result indicates a correlation between students' achievement and self-regulated learning with the r = 0.270 and p < .001. However, the result shows that the correlation is marginal.

Table 8. The correlation between students' achievement toward self-regulated learning.

Pearson's Correlations

Variable		GPA	Average
1. GPA	Pearson's r	—	
	p-value	—	
2. Average	Pearson's r	0.270***	—
	p-value	< .001	—

* p < .05, ** p < .01, *** p < .001

Several factors can affect students' self-regulated learning. Students cannot use self-regulation strategies, lack self-efficacy, and feel stress during the study (Jouhari et al., 2015)**.** In terms of pursuing goals, especially facing obstacles and setbacks, attention control is essential to self-regulation (Diehl et al., 2006). Self-regulated learning is important for students in an online environment. High degree of student autonomy and minimal teacher involvement is provided by self-regulated learning (Ifenthaler, 2013). However, students need self-regulated support to achieve academic success, particularly in an online environment. Four supports that can be used to maximize online learning are 1) conceptual, 2) metacognitive, procedural, and 4) strategic supports (Hill & Hannafin, 2001). In addition, students can get support in various forms during participating in online learning, such as tools, additional cues, feedback, or guidance (Zheng, 2016).

Furthermore, students also need scaffolding in online learning situations. Online teachers' monitoring efforts can scaffold students to regulate their learning. Scaffolding can be varied. Teachers can monitor, both individual and group activities through various social media platforms such as Twitter. Another scaffolding is guiding students' interaction. The last example of scaffolding is promoting social interaction (Cho & Shen, 2013).

CONCLUSION

The results show that, in average, females are higher in self-regulated learning than male students. Moreover, self-regulated learning of

biology education students is higher than biology students. The results also indicate that there is no significant relationship between male and female students towards self-regulated learning and study programs. The results also show a correlation between student achievement and self-regulated learning. Future studies should identify factors influencing online self-regulated learning, particularly for undergraduate science major students and pre-service science teachers.

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