

# The Relationship between Self-Regulated Learning and Students' Critical Thinking Skills

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**Abstract.** Self-regulated learning can provide self-reinforcement in gaining academic achievement which in this case is the ability to solve problems by using critical thinking skills. Students need to know their characteristics so they can plan learning strategies and self-regulation processes according to their characteristics so that their critical thinking skills can improve. The purpose of this research is to determine the level of conscientiousness and self-regulated learning (SRL) of university students in the elementary school teacher education study program at Sebelas Maret University. The research sample was 105 students from the class of 2022. The data collection technique used was a test. The data analysis used inferential statistical analysis. The results showed that the SRL of the students was 35% which was mostly in the medium category, while their critical thinking was 35% and mostly in the low category. Based on the Kendal Tau correlation test, the relationship between SRL and critical thinking skills was  $0.000 < 0.05$ . The results of this research can be used as a reference to measure the correlation between SRL and the critical thinking of university students.

**Keywords:** Self-Regulated Learning, Critical Thinking, University Students

## 1. Introduction

Education is an effort to increase human self-worth by developing the potential and uniqueness of a person both physically and spiritually (Novarita, 2015). The Republic of Indonesia's Law No. 20 of 2003 explained that education is designed to educate the nation's life, develop children's potential, and build a dignified civilization (Kusniawati, 2020). Education has an important role in changing everyone's character and attitude so that they can adjust themselves to the existing science and technology developments (Putra, ED, & Amalia, 2020). Furthermore, education in the 21<sup>st</sup> century focuses on 3 aspects, namely cognitive, affective, and psychomotor (Affandy, 2019). The competency demands of students in the 21<sup>st</sup> century are known as the "21<sup>st</sup> Century Partnership Learning Framework" in which one of the points is the ability to think critically and solve problems (Firmansyah, A., & Rizal, 2019). Critical thinking skills are important to have because they can help students solve problems quickly (Putri, 2018). Therefore, everyone needs to have the ability or skills in critical thinking (Kurniawati, D., & Ekayanti, 2020b).

### 1.1. Problem Statements

Critical thinking skills are also important for every individual. However, based on several survey results, Indonesia has a low level of critical thinking skills. Based on the survey results of The Trends in International Mathematics and Science Study (TIMSS) in 2015, Indonesia was ranked 44<sup>th</sup> out of 49 countries in terms of mastery of knowledge of facts, procedures, and concepts. This shows that 54% of students in Indonesia have poor skills in science and cognitive domains. The 2018 Program for International Student Assessment (PISA) data also showed the low ranking of Indonesian students. Indonesia was ranked 71<sup>st</sup> out of 79 countries in the science category, with an average below international standards. The lack of application of critical thinking skills in solving higher-order thinking questions became one of the causes (Sa'adah, 2020).

Based on the results of an interview with one of the lecturers at the Elementary School Teacher Education (*Pendidikan Guru Sekolah Dasar/PGSD*) study program of Universitas Sebelas Maret, it was found that students from Batch 2022 had a low level of critical thinking when viewed from the results of the odd semester final exams. He also stated that the low level of critical thinking was due to the transition from high school to tertiary education and the transition of teaching and learning activities from online to offline. The difference in the teaching process, that is, from teacher-centered learning to student-centered learning required students to adjust themselves. The diversity of characteristics of each individual was also a factor causing the low level of students' critical thinking. The results of the interview above showed that the students of batch 2022 of PGSD of UNS had not maximized their critical thinking skills during lecture activities. The low level of critical thinking skills in Indonesia was also supported by research conducted by Chrestella, Haka, and Supriyadi (2021), Farcis (2019), and Yanti (2019) which showed that the level of students' critical thinking skills was relatively low.

Learning processes and conditions affect the level of achievement of higher-order thinking skills (Nurbaeti, 2015). Three variables shape learning conditions: achievement goals and characteristics of the field of study, constraints, and student characteristics (Abid & Rahaju, 2018). Factors such as background, learning styles, thinking processes, age, chronology, personality, level of maturity, beliefs, and environment can influence student characteristics (Ramalisa, 2013). Furthermore, the differences that each student has cause the characteristics and ways of learning for each student to be different (Suci, 2019). Differences in thinking processes, learning modalities, and obstacles encountered also result in each student having different characteristics (Mulyani, et.al. 2020).

Self-regulated learning (SRL) is an educational psychology term regarding learning skills which include students' understanding of thinking abilities, self-motivation, and thinking processes to achieve their goals (Munahafi., 2022). Zimmerman (2000) stated that self-regulation is a term that reflects students' process of focusing thoughts, feelings, and actions to achieve set goals. Therefore, it can be concluded that self-regulated learning is a student activity in managing cognition, motivation, and behavior to achieve learning goals.

Self-regulation is important for students because the main function of education is to develop long-term skills and become a lifelong learner. The four characteristics of independence in learning (self-regulated) are awareness of goals, responsibility, continuity, and activeness in learning (Kusniawati, 2020). Individuals with good self-regulation tend to achieve optimal learning achievements (Faruq, 2021). This is also supported by Zimmerman and Zimmerman (2010) who stated that someone with self-regulated skills tends to be successful in dealing with problems or challenges that exist in the community and working environment because this ability can help students improve their critical thinking skills.

The selection of students as research subjects was based on Jean Piaget's theory which stated that students are included in the stage of formal operational development (Rohani, 2017). This stage requires a person to be independent in dealing with the existing developments both physically and psychologically. As a result, they are asked to be responsible and be independent during the learning process (Maulidya, et. al., 2018). This reason is the background for the researchers to choose university students as the research subjects.

## **1.2. Related Research**

Previous research on the topic of self-regulated learning and critical thinking skills included research on the level of students' critical thinking skills based on self-regulation through the guided discovery learning approach. The results showed that guided discovery learning influenced students' critical thinking skills and self-regulation. In addition, research on students' critical thinking skills and self-regulated learning during the COVID-19 Pandemic conducted by Wayudi, & Santoso (2020) showed that there was a significant relationship between critical thinking skills and student learning independence.

Research that proved that self-regulated learning helped students deal with problems was carried out by Rahmawati & Alaydrus (2021) who argued that the critical thinking skills of students who had self-regulated learning were not very different. Second, research conducted

by Rahmawati & Alaydrus (2021) found that students with low and high SRL levels had different scores on the mathematical critical thinking test. Based on the data above, it can be concluded that it is easier for students to solve problems if they have a high level of self-regulated learning. The third study conducted by Miatun (2020) revealed that the critical thinking abilities of students with low and high SRL were very different. Furthermore, research by Anas & Alsa (2018) stated that there was a relationship between self-regulated learning and student achievement.

However, this research is different from previous research. This research topic raised are skills in the 21<sup>st</sup> century that are relevant to the current situation. This research examined the relationship of SRL in the process of improving the quality of learning toward the improvement of students' critical thinking skills. Students need to have awareness in the learning process so they can know or be aware of the characteristics of their thinking and can determine learning strategies as self-regulation efforts to improve critical thinking skills. Variable X in the form of self-regulated learning was chosen because SRL is related to one's ability to regulate one's thoughts and control feelings and actions during the learning process. As a result, students can achieve academic achievement which includes the ability to solve problems with critical thinking skills with the ability (Napis, N., & Rahmatulloh, 2021).

### **1.3. Research Objectives**

This research aimed to determine the relationship between self-regulated learning and the critical thinking skills of the students of the Elementary School Teacher Education (*Pendidikan Guru Sekolah Dasar/PGSD*) of Universitas Sebelas Maret. The significance of this research is that critical thinking skills are needed to deal with very large levels of data complexity in the era of Big Data. Every human being is also a critical thinker and something that distinguishes them is their characteristics (Paul, R., & Elder, 2019). Therefore, students need to know their characteristics so they can plan learning strategies and self-regulation processes based on their characteristics so that their critical thinking skills can increase.

## **2. Theoretical Framework**

### **2.1. Self-Regulated Learning**

Zimmerman (1990) explained that SRL is a concept about a person's process of controlling his or her learning activities. Furthermore, Boekaerts (1999) argued that SRL utilizes knowledge, skills, and attitudes related to other learning contexts and is not limited by time. In addition, Zimmerman (2000) stated that self-regulation refers to the process of students focusing their thoughts, feelings, and behavior to achieve learning goals.

Schunk, D. H., & Mullen (2013) suggested that learning that applied self-regulation strategies could improve student performance in knowledge transfer activities. Self-regulation skills could increase students' academic success, and these skills could be better in the educational environment (Efe, H., Gül, R., & Topsakal, 2022). SRL is defined as independent learning because students can control their learning process by using strategies that are appropriate to their understanding of the tasks given, strengthening decision-making and self-motivation (Abdullah, 2019). Self-regulated learning is a learning process that is integrated by a set of motivational beliefs, behaviors, and metacognitive activities that are planned and adapted to support the achievement of personal goals (Sun et al., 2018). Furthermore, SRL is an independent and active learning process conducted by planning, observing, controlling, and evaluating oneself systematically to achieve learning goals (Anwar et al., 2022).

Based on the statements above, it can be synthesized that SRL is the a person's ability to focus their thoughts, feelings, and actions to increase knowledge, skills, and attitudes that are relevant to achieving the learning objectives that have been set (Zimmerman & Zimmerman, 2010).

### **2.2. Critical Thinking Skills**

Thinking is a process of transforming information to produce new mental representations involving complex processes of reasoning, imagination, and problem-solving (Alsaleh, 2020).

As times change, the demand for the ability to think is something that everyone master, especially in the 21<sup>st</sup> century (Mahanal., 2019). The 21<sup>st</sup> century is referred to as the "knowledge century" because education is focused on improving students' skills. The demands of the 21<sup>st</sup> century are known as 4C which consist of creative thinking, communication, collaboration, critical thinking, and problem-solving (Bahtiar, 2023). Students need to have 21<sup>st</sup>-century skills to be able to solve complex problems, collaborate, communicate, acquire skills in obtaining information, and adapt to current situations to be successful in global competition (Vacide Erdoğan, 2019)

In the development of the 21<sup>st</sup> century, students' skills in critical thinking are important and must be developed to be able to compete globally. Ennis (1996) stated that critical thinking is a thinking process with a clear and reflective foundation with an emphasis on facts. Fisher (2009) argued that critical thinking is an attempt to evaluate every answer or knowledge obtained from several further conclusions. Furthermore, Facione (2011) stated that the basic concepts in critical thinking are the ability to interpret, analyze, evaluate, draw conclusions, explain, and self-regulate. Critical thinking is the process of collecting, interpreting, analyzing, and evaluating information to obtain reliable conclusions (Fristadi & Bharata, 2015). Critical thinking skills are driven by higher-order thinking skills, including reasoning, analysis, and evaluation (Supriatna, 2020). Critical thinking is a process that ends in making logical conclusions or decisions about what to believe and what actions to take (Elder, L., & Paul, 2020). Students' critical thinking skills can be improved if they are properly developed and trained in the learning process (Yonanda, D. A., Yuliaty, Y., & Saputra, 2019).

Ennis (2011) revealed that critical thinking is the ability to provide reasons (reasonable) and be reflective of what is believed and done. Ennis in "Goals for a Critical Thinking Curriculum" stated that critical thinking skills include two main factors, namely character (disposition) and skills (ability). As stated by Putri (2018), "Critical thinking is important because those who can do so can have a greater ability to solve difficulties." Therefore, the ability to think critically is very important for everyone. (Kurniawati, D., & Ekayanti, 2020a) in their research also stated that critical thinking skills are very important for students because they can help students solve problems appropriately. In addition, critical thinking is lifelong and can help students manage their learning skills (Kwan, Y. W., & Wong, 2015). Ennis admitted that having minimal expertise in a certain field can help someone apply critical thinking skills (AB. Dimas Ghimby, 2023). Critical thinking is also defined as a person's ability to observe events, situations, or thoughts, and then make comments or decisions by studying the reliability and validity of knowledge according to standards of logic and thought (Birgili, 2015). Pascarella and Terenzini (in Nuraida, 2019) explained that this skill is related to a person's ability to find problems and arrange their assumptions in arguments, identify important correlations, make a synthesis of some correct data, interpret whether the conclusion is correct, evaluate evidence, make self-corrections, and solve problems. In addition, higher-order thinking skills include the ability to analyze, assess, evaluate, and make logical and rational decisions (Mardhiyah et al., 2021).

Based on the theories above, it can be synthesized that critical thinking is the skill of thinking reflectively in identifying, analyzing, interpreting, and evaluating data of evidence and information so that someone can make decisions rationally and logically (Ennis RH, 2011; P. A. Facione, 2011).

### **3. Method**

#### **3.1. Research Design**

This research is a quantitative research using the correlational research design because it refers to the purpose of this study, which is, to determine the relationship between self-regulated learning (X) and critical thinking skills (Y). The purpose of correlational research is to determine whether there is a relationship between variables or to make assumptions about the relationship (Sugiyono., 2017).

### 3.2. Respondents

The sample was a part of the population, in this case, students in classes A, B, C, D, E, and F (214 students) from batch 2022 Elementary School Teacher Education (*Pendidikan Guru Sekolah Dasar/PGSD*) Study Program were the sample of this research. The sampling of the population was carried out randomly, and the results of random sampling were successive, namely classes 2B, 2E, and 2F, totaling 105 students. The selection of the sample was based on the following reasons: (1) Random sampling was the sampling technique used in similar research at the PGSD Study Program in Surakarta. This sampling technique was based on the previous sampling method, where the probability of sampling was used with cluster random sampling. (2) The materials for the critical thinking skills test used in this research were taken from the Human and Environment materials which were taught in semester 2 or Class of 2022. (3) The selection of the sample was because they generally developed cognitive development at the formal operational stage in which children think in more abstract, idealistic, and logical ways. This stage required students to be independent in dealing with the changes that occurred both physically and psychologically.

### 3.3. Data Collection

Non-test data collection in the form of a scale was carried out to measure SRL and data collection in the form of tests was carried out to measure critical thinking skills variable.

#### 3.3.1. Instruments of Self-Regulated Learning

In this study, the measurement of the SRL variable used the Assessing Academic Self-Regulated Learning tool consisting of 32 items and developed by Wolters, Pintrich, and Karabenick in 2003. This measuring instrument was then adapted and adjusted to the conditions at the research site. This scale was designed to observe student self-regulation in general and the instrument was intended for use at the undergraduate level. The components of this scale were divided into three: the metacognition scale, the motivation scale, and the behavior scale. The metacognition factor measured students' understanding and self-awareness processes in determining learning as a thinking process. The motivational factor analyzed the goal values and students' beliefs in their abilities and their anxiety about examinations. Behavioral factors evaluated individual efforts to self-regulate, choose, and create a supportive learning environment.

The assessment used was based on the scale from Assessing Academic Self-Regulated Learning with modifications from 5 points to 4 points on a Likert scale with options consisting of strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). The modification of the Likert scale removed the middle or neutral answer category to eliminate the weaknesses of the five-level scales. This occurred because there were differences of opinion among Indonesian researchers in using the middle alternative. Besides, Indonesians have several characteristics that encourage a tendency to choose the middle answer alternative when there is a Likert scale (Widhiarso, 2012). The calculation of the final score was done by adding up all item scores and taking the average value. The higher a person's score, the better their level of SRL. The statements on the scale consisted of favorable and unfavorable statements. The SRL questionnaire assessment score can be seen in Table 1 below:

**Table 1.** The Score of Self-Regulated Learning Answers

Favorable Items		Unfavorable Items	
<b>Strongly disagree (SD)</b>	1	Strongly agree (SA)	1
<b>Disagree (D)</b>	2	Agree (A)	2
<b>Agree (A)</b>	3	Disagree (D)	3
<b>Strongly agree (SA)</b>	4	Strongly disagree (SD)	4

#### 3.3.2. Instruments of Critical Thinking Skills

Students' critical thinking skills were measured using a test, that is, a critical thinking test that consisted of 10 questions and was structured using a two-tier multiple-essay test. The two-tier multiple essay test is a form of essay test consisting of 2 tiers or 2 levels. The first level asks about

scientific concepts and the second level asks about the reasons for the answers at the previous level (Pratama, 2019; Utami., 2019).

The reason for choosing the test in the form of an essay was because the multiple choice questions were unable to show the flow of solving the problems carried out by the test takers so the accuracy and small errors that led to fatal answer errors could not be observed.

The score categories of critical thinking are presented in Table 2 below:

**Table 2.** The Categories of Student Critical Thinking Scores

No	The obtained scores	Category
1	$81.25 < X \leq 100$	Very high
2	$71.5 < X \leq 81,25$	High
3	$62.5 < X \leq 71,5$	Moderate
4	$43.75 < X \leq 62,5$	Low
5	$0 < X \leq 43.75$	Very low

Source; (Karim & Normaya, 2015)

### 3.4. Data Analysis

The data analysis technique used inferential statistical analysis because the data used did not meet one of the prerequisites for parametric analysis, namely the normality and linearity tests. Since the data did not meet one of the requirements, that is, non-linear, non-parametric data analysis was used.

Hypothesis testing using non-parametric statistics was carried out if the assumptions required to use parametric statistics cannot be fulfilled (Purwanto, 2011). One of the conditions for using the non-parametric method is that the sample is taken by random (random sampling). The use of non-parametric statistics in correlation research can be done in several ways, namely the contingency coefficient, the Spearman rank correlation coefficient, and the Kendall Tau correlation coefficient. This research has a large number of samples, namely  $N > 10$ . Therefore, this study used the Kendall-Tau correlation coefficient.

The significance value, the level of closeness, and the direction of the relationship were calculated to determine the relationship between variables after finding the results of the correlation coefficient.

The following table interprets the correlation coefficient:

**Table 3.** The Interpretation of the Correlation Coefficient

Coefficient of Correlation Value	Levels of Correlations
<b>0.000 – 0.199</b>	Very low
<b>0.200 – 0.399</b>	Low
<b>0.400 – 0.599</b>	Moderate
<b>0.600 – 0.799</b>	Strong
<b>0.800 – 1.000</b>	Very Strong

Source: Sudijono (2012)

If the significance value of Sig. (2-tailed)  $> 0.05$ , then  $H_a$  is rejected and  $H_o$  is accepted, but if the Sig. (2-tailed)  $< 0.05$ , then  $H_a$  is accepted and  $H_o$  is rejected. The direction of the relationship between variables is seen from the number of correlation coefficients. A positive

relationship is called a unidirectional relationship and a negative relationship is called a counter-relationship.

### 3.5. Validity and Reliability Instruments

The results of the instrument validity test on the SRL scale consisted of 56 statement items. Based on the results of Aiken's  $v$  calculations with 5 validators, it produced 40 valid statements with a result of  $V \geq 0.78$ . After that, the 40 statements were tested on classes A, C, and D. The results of the calculation of the internal consistency index with  $R_{xy}$  were  $\geq 0.3$ . In the calculation of the internal consistency index on SRL instruments that were tested, there were 32 valid statements out of 40 statements. The calculation of the reliability of the SRL instrument was done using the Alpha Cronbach formula in the SPSS 25 program. The reliability score of the 32 statements of the SRL instrument was 0.885 and based on the decision-making procedure, if the reliability coefficient was 0.70 or  $r_{11} \geq 0.70$ , then it could be said that the instrument of self-regulated learning was reliable.

The validation of the test instrument was carried out by expert judgment from the perspective of the validity of the grid, content, construct, and language. In addition, testing the validity of the test was carried out by calculating the results of the experts' assessment using Aiken's  $v$  assessment and calculating the level of difficulty and discriminating power of the questions. The results of the validity test were calculated using Microsoft Excel and then the reliability test calculations were carried out using the SPSS 25 program

The results of the validation test for the science materials consisted of 30 questions. Based on the results of Aiken's  $v$  calculations with 5 validators, it produced 30 valid statements for biology materials, 28 valid statements for chemistry materials, and 29 valid questions for physics materials with the results of each material  $V \geq 0.8$ . The researchers used 15 questions that had the highest level of validity, and the 15 questions were then tested on classes A, C, and D. The results of the trials were then analyzed for the level of difficulty and the discriminating power of each item. The results of the calculation of the difficulty level with a range of difficulty index values was  $0.30 \leq P \leq 0.70$ . The level of difficulty in the science materials that had been tested produced 15 valid statements out of 15 statements. Furthermore, based on the calculation of the discriminating power, the differential index which was equal to or greater than 0.30 was considered to have a good differential index ( $D \geq 0.30$ ). The discriminating power in science materials that had been tested produced 10 valid questions out of 15 statements.

The results of the reliability of the critical thinking skills test instrument were calculated using the Alpha Cronbach formula using the SPSS 25 program. The reliability test of 10 questions on the instrument for critical thinking skills in sciences was 0.831 and 0.678 assuming a rounding of 0.70 and 0.825 so that based on the basis for the decision making, if the reliability coefficient is 0.70 or  $r_{11} \geq 0.70$ , it can be said that the critical thinking skill instrument is reliable.

## 4. Findings

### Relationship of Self-Regulated Learning with Critical Thinking Skills

SRL data were obtained from a scale filled in by the students of batch 2022 as the respondents. Tables and histograms of the frequency distribution of self-regulated learning data for the research sample can be seen in Table 4 below:

**Table 4.** The Frequency Distribution of Self-Regulated Learning Data

No	Class interval	frequency (f)	Percentage of frequency (f%)	Cumulative Frequency Percentage (fk%)
1	79-84	6	6%	6%
2	85-90	22	21%	27%
3	91-96	25	24%	50%
4	97-102	23	22%	72%

<b>5</b>	103-108	8	8%	80%
<b>6</b>	109-114	11	10%	90%
<b>7</b>	115-120	9	9%	99%
<b>8</b>	121-126	1	1%	100%
<b>Total</b>		105	100%	

Data on critical thinking skills, namely data obtained from tests taken by the students of batch 2022 as respondents. Tables and histograms of the frequency distribution of students' critical thinking skills data can be seen in Table 5 below:

**Table 5.** The Frequency Distribution of Critical Thinking Skills Data

No	Class Intervals	Frequency (f)	Percentage of Frequency (f%)	Cumulative Frequency Percentage (fk%)
1	28-37	1	1%	1%
2	38-55	19	18%	19%
3	56-73	52	50%	69%
4	74-91	32	30%	99%
5	92-109	1	1%	100%
6	110-127	0	0%	100%
7	128-145	0	0%	100%
8	146-163	0	0%	100%
<b>Total</b>		105	100%	

Based on Table 5, the lowest frequency of critical thinking scores is found in intervals of 28-36 and 91-108 with 1 student each. The second lowest frequency is in the interval of 37-54 with 19 students. On the other hand, the highest frequency is in the 55-72 interval with 52 students. The second highest frequency is in the 73-90 interval with 32 students. The data collected is in line with a total of 105 students with a percentage of 100%.

The results of the critical thinking skills is presented in Table 6 below:

**Table 6.** Data on the Critical Thinking Skills Category on Biology

No	Intervals	Category	Frequency (f)	Frequency of percentage (f%)
1	81,25 < X ≤ 100	Very high	20	19%
2	71,5 < X ≤ 81,25	high	17	16%
3	62,5 < X ≤ 71,5	Moderate	29	28%
4	43,75 < X ≤ 62,5	Low	37	35%
5	0 < X ≤ 43,75	Very low	2	2%
<b>Total</b>			<b>105</b>	<b>100%</b>

Table 6 showed that 20 students achieved very high critical thinking scores of 81.25-100, 17 students achieved high category scores of 71.6 – 81.25, 29 students achieved a moderate category with scores of 62.6 – 71.5, 37 students had scores of 43.76 – 62.5, and 2 students achieved very low category with scores of 0 – 43.75. This showed that the majority of the critical thinking skills of the research sample were low.

This research proposes a working hypothesis that there is a positive and significant relationship between SRL and critical thinking skills. The working hypothesis ( $H_a$ ) was tested whether it was accepted or rejected.

The results of Kendall Tau's correlation analysis between conscientiousness and critical thinking skills resulted in a calculation of a significance value of  $0.000 < 0.050$  with a positive correlation coefficient of  $0.265^{**}$ . Based on the results of these significance values, it can be concluded that the working hypothesis was accepted so that there was a positive and significant relationship between self-regulated learning and critical thinking skills.

**Table 7.** The Data of Hypothesis Test Results

Nonparametric Correlations			Self Regulated Learning (X2)	Critical thinking skills (Y)
Kendall's tau_b	Self-Regulated Learning (X2)	Correlation Coefficient	1.000	.265**
		Sig. (2-tailed)	.	.000
		N	105	105
	Critical thinking skills (Y)	Correlation Coefficient	.265**	1.000
		Sig. (2-tailed)	.000	.
		N	105	105

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The hypothesis test showed that the significance value of the Kendall Tau correlation between the variable of self-regulated learning (X) and critical thinking skills (Y) was  $0.000 < 0.05$  with a positive correlation coefficient value of  $0.265^{**}$ , so it can be concluded that there was a relationship between SRL and positive and significant critical thinking skills. This means that if SRL increases, the students' critical thinking skills also increase.

## 5. Discussion

The relationship between SRL and critical thinking skills occurred because of students' ability to focus their thoughts, feelings, and actions to encourage students to develop knowledge, skills, and attitudes in the learning process. Facione, (2011) explained that one indicator of someone's ability to think critically is the ability to self-regulate. Self-regulation is defined as a condition in which students consciously regulate their existence in dealing with problem-solving by regulating and monitoring their cognitive activities (Ihor & Ruslana, 2021). (Cera, R., Mancini, M., & Antonietti, 2013) stated that self-regulation is a person's awareness to control cognition and other elements used during the thought process. In particular, this relates to evaluating their ability to draw conclusions through questions, confirmation, validation, and improvement.

(Kwan, Y. W., & Wong, 2015) stated that cognitive abilities in critical thinking are influenced by factors within the individual and environmental factors, especially affective factors in conditioning themselves and their environment. Affective ability is a person's ability to achieve academic goals by controlling, managing, and managing their thoughts, emotions, actions, and environment. This ability is then called the ability of self-regulated learning (SRL) (Zimmerman, 1989). This is in line with the theory of constructivism and social cognitive theory. Constructivism theory has assumptions similar to social cognitive theory which states that people, behavior, and the environment interact with one another (Amineh, R. J., & Asl, 2015).

Constructivism theory views learning as an active process of students building knowledge through various means such as dialogues, texts, physical experience, and so on (Waseso, 2018). In addition, the theory of constructivism refers to a constructive learning process, building abilities, and understanding (Efgivia., 2021) In this research, students needed SRL in the process

of constructing their knowledge. The role of SRL is to focus thoughts, feelings, and actions to develop knowledge, skills, and attitudes related to the learning context to build thinking skills.

Along with the social cognitive theory, individuals as agents are responsible for developing themselves and making environmental changes through their actions (Sri Muliati Abdullah, 2019). Students with a high level of SRL supported by critical thinking skills can manage their learning process well. This is because critical thinking skills can help students adapt to problems that exist in their lecture and social environment in line with what they have learned with the help of self-regulation (AB. Dimas Ghimby, 2023). Based on the explanation above, it can be understood that students' ability to self-regulate their learning allows them to analyze their experiences by reflecting on their experiences and confirming the knowledge they have so that they can gain knowledge about themselves and their surroundings. This ability is in line with the concept of critical thinking skills,

The results of this research are in line with previous research regarding the relationship between self-regulated learning and critical thinking skills (Hidayati & Kurniati 2018). This research explains that with SRL, students can interpret, analyze, and conclude a lesson. This ability can shape students' critical thinking skills. Self-regulated learning can also help students acquire and retain knowledge in a structured and methodological way (Broadbent & Poon, 2015). Research conducted by Eda, Ö. Z., & ŞEN (2021) also showed that SRL is important in improving students' critical thinking skills.

## **Conclusion**

Based on the explanation above, it can be concluded that there was a positive and significant relationship between SRL and the critical thinking skills of the students of PGSD of Universitas Sebelas Maret. The significance value of the hypothesis test using Kendal Tau was  $0.000 < 0.05$  with a positive correlation coefficient of 0.265. Based on the results of these significance values, it was concluded that the working hypothesis was accepted so that there was a positive and significant relationship between SRL and critical thinking skills. The results of this study can be useful to improve critical thinking skills by increasing the ability of self-regulated learning for students.

## **Limitation**

The limitation of this research lies in the limited number of research subjects. Limited time resulted in the researchers' inability to conduct research in a broader scope. The limitations of this study are that researchers only analyzed the relationship between self-regulation and critical thinking, while researchers cannot control other factors that influence this relationship.

## **Recommendation**

This research has implications for students to improve critical thinking skills and self-regulated learning abilities. In addition, this research has a positive impact on lecturers and other educators to encourage students and apply relevant learning strategies and methods so that critical thinking skills and students' SRL abilities can increase. Recommendations based on the results of this research are for further research, namely the need to analyze other factors that have relevance to students' critical thinking abilities. Further research also needs to analyze internal and external factors together so they can find out the significant differences.

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## Conflict of Interest

There are no conflicts of interest during this research and the article publication.

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