

Meta-Analysis: The Effect of Self-Regulated Learning (SRL) on Student Ability Levels

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Abstract: This study aims to identify the Effect Size and Publication Bias of the research results of the relationship of Self Regulated Learning (SRL) to the Student's Mastery Level with various conclusions. This research is also used to identify the level of positive correlation by Meta-Analysis. The methodology used in this research is a meta-analysis study of 14 research results. In this study, the Effect Size values were obtained in the range of -0.13 to 1.22. Based on the estimated correlation values, which currently stand at 0.498 with a confidence interval of 0.284 to 0.613, it can be said that there is a positive relationship between Student's Mastery Level and Self Regulated Learning (SRL). In addition, by using the Egger's Test, a p-value of $0.166 > (\alpha = 0.05)$ was obtained, so that Publication Bias was not detected by the Meta-Analysis study. In general, it can be stated that Self Regulated Learning (SRL) has a statistically significant positive influence on the level of student mastery. The greater the motivation to learn independently, the better the students' academic mastery.

Keywords: self-regulated learning, student's mastery level, publication bias.

INTRODUCTION

The role of Human Resources (HR) in supporting the development of a country is the main key in the era of cross-country competition. The current era of the Industrial Revolution 4.0 demands the fulfillment of the needs of qualified, independent, and technologically literate Human Resources (HR) (Rohida, 2018). Of the several factors that influence the improvement of the quality of Human Resources (HR), one of them is the role of education undertaken by everyone. Policy improvements in the implementation of education are needed to ensure the success of education programs from early childhood to higher education. A good education program is a form of future investment that determines the advancement of civilization and the readiness of human resources to compete internationally (Desmawan, et al., 2023). 5 (five) components determine education policy, namely the existence of goals, planning, implementation programs, decisions, and positive impacts caused (Elwijaya, Mairina, & Gistituati, 2021).

One indicator of the advancement of education can be measured by the Student Mastery Level, which is the level of student success after experiencing the learning process (Idrus, 2019). The level of student mastery can be identified through the Academic Achievement Index, which comes from the results of learning efforts that a

person makes optimally. Many studies have discussed and analyzed the Student Mastery Level, from the point of view of cognitive aspects and psychomotor aspects. But not a few reviews from the affective aspect, one of which is by paying attention to internal factors, namely the existence of Self Regulated Learning patterns.

Self-Regulated Learning (SRL) which can be called independence in learning is the ability of someone who has knowledge of effective learning strategies and knows the application of this knowledge so that they can regulate themselves in learning (Ruswana, 2018). The ability to learn independently will form students or students have good motivation and ability to learn throughout life (Oishi, 2020). The self-learning process is a learning model that provides opportunities for students to take initiative in setting goals and creativity according to their learning styles (Pritandhari & Wibawa, 2021).

There have been many studies that discuss the relationship between Self Regulated Learning (SRL) and students' ability to understand the topic or material being studied. In some of these studies, it is stated that there is a close relationship between the two variables with various correlation measures. This fosters the desire to analyze the results of these studies to measure whether there is Publication Bias in the research data and explore the existence of more general conclusions from studies that examine the relationship between Student Mastery Level and learning techniques using Self Regulated Learning (SRL) (Alhadi & Supriyanto, 2017). The statistical method that is widely used to carry out the analysis process is Meta-Analysis, one of which is used by (Sari & Hardini, 2020).

Meta-analysis is a quantitative statistical method that analyzes quantitative data from the results of studies that have been conducted to identify the alignment of results in studies (Retnawati, 2018). Meta-analysis uses statistical measures obtained from several studies on the same topic to determine whether the results studied are consistent. In the study of the relationship between SRL and the level of student mastery, in addition to identifying the pattern of data distribution, this research is also used to confirm the existence of a strong relationship between the influence of Self Regulated Learning (SRL) on student ability or student mastery level through Meta-Analysis. By applying meta-analysis, it can be shown whether there is publication bias from the results of these studies.

RESEARCH METHODS

The research began with a literature study of research publications on the effect of Self Regulated Learning (SRL) on Student Mastery Levels from several scientific articles that can be accessed online for the last 10 (ten) years. There are several keywords/phrases used for the literature study search, namely the effect of self-regulated learning on student mastery level, the effect of self-regulated learning on academic achievement, self-regulated learning, the effect of self-regulation, self-regulated learning strategies, meta-analysis of self-regulated learning and correlation between self-regulated learning and academic achievement. Access to this journal article is carried out through a website that provides information on research results, namely Google Scholar.

The search process resulted in 35 (thirty-five) suitable research papers published in scientific journals, proceedings, and theses. Furthermore, the research was selected based on the following criteria:

- a. Primary research/studies consisting of experimental studies or surveys that examine the Effect of Self Regulated Learning (SRL) on Student Mastery Levels.
- b. A research report in a primary study that analyzes the statistical measure of Correlation (ρ) as a measure of the direct relationship between the Effect of Self Regulated Learning (SRL) on Student Mastery Level.

The next step is to compile a resume of research results and identify research results which include categorizing the suitability of criteria and summarizing the statistical measures obtained. After the identification process of the research sample is fulfilled, the correlation value and test results of each study are examined. Then the Effect Size and Standard Error Effect Size were determined based on the correlation coefficient value obtained from the study. The determination of the Effect Size value is based on the correlation coefficient value between the two variables obtained based on the reporting of the correlation between two continuous variables in the research results. Here are some of the equations used. (Retnawati, 2018).

$$t = \sqrt{F} \quad (1)$$

$$r = \frac{t}{\sqrt{t^2 + N - 2}} \quad (2)$$

where:

F = test statistics

N = sample size

r = effect size

Then the Effect Size transformation is determined which is obtained from equation 2:

$$z = Y_i = 0,5 \times \ln \frac{1+r}{1-r} \quad (3)$$

And the variance of the Effect Size transformation is as follows:

$$V_z = V_{Y_i} = \frac{1}{n-3} \quad (4)$$

The Meta Correlation Analysis method consists of two choices of analysis models, namely the Fixed Effect Model and the Random Effect Model. The model chosen adjusts to the characteristics of the research data. In data that tends to vary, a random effect model can be used, while in data that tends to be uniform, a fixed effect model can be used.

After determining the right model according to the identification of variance heterogeneity, the calculation of Summary Effect is carried out which consists of several stages. The following stages are: calculation of the weight of each study, tabulation of data, calculation of the weighted average effect, determination of the confidence interval, calculation of the p-value and transformation of the weighted average effect value and its confidence interval into a correlation. Data distribution patterns will be presented graphically in the form of Forest Plot and Funnel Plot. Then the last stage of the Meta-analysis Procedure is the interpretation of the analysis results.

All stages of data analysis in this study used one of the Open Sources software, namely JASP 0.16.3 software, which can be obtained at the following link: <https://jasp-stats.org>. The operation of this software is relatively easy and is widely used in several social research fields.

RESULTS AND DISCUSSION

Identification of Research Samples

From the search results through the Google Scholar search engine, 35 (thirty-five) research titles were obtained that explained the relationship between SRL and student mastery. However, among these 35 titles, there are only 14 (fourteen) research results that have conformity with the criteria, while 21 other research results do not have conformity with the criteria. Eleven of the 21 studies that did not fit the criteria consisted of six studies that measured the relationship using regression analysis without including

the correlation coefficient and five other studies focused on discussing the final results of the assessment rather than the relationship between variables. The remaining four studies were identified as more suitable for using Meta Contracts Analysis and Meta Pre-Post Contracts Analysis. The last six consisted of five research reports that used non-student research objects and one research result that was not presented by the official scientific media.

Transformation of Effect Size Value and Effect Size Standard Error

Table 1 presents 14 (fourteen) research results that examine the relationship between Self Regulated Learning (SRL) and Student Mastery Level with the correlation coefficient obtained and the transformation of the effect size value and standard error effect size.

Table 1. Correlation coefficients and effect size of research results

No	Authors	Correlation coefficients (r)	Sample Size (n)	Effect Size	Standard Error of Effect Size
1	(Supriyanto, 2015)	0.290	20	0.29857	0.24254
2	(Hasanah, Maria, & Lutfianawati, 2019)	0.445	187	0.47845	0.07372
3	(Ruswana & Zamnah, 2018)	0.649	33	0.77357	0.18257
4	(Sukmawansyah, Hakim, & Hartono, 2019)	0.42	73	0.44769	0.11952
5	(Darmiany, 2016)	0.277	74	0.28443	0.11868
6	(Andiani, 2018)	0.690	33	0.84796	0.18257
7	(Ritonga, Vianty, Alwi, Suhendi, & Sofendi, 2021)	0.104	175	0.10438	0.07625
8	(Meilisa, Sari, & Kasih, 2021)	0.218	197	0.22156	0.07180
9	(Ramadhani & Laili, 2021)	0.376	84	0.39539	0.11111
10	(Syahniar, 2018)	0.517	87	0.57224	0.10911
11	(Ningrum, Kumara, & Prabandari, 2018)	0.277	219	0.28443	0.06804
12	(Edi, 2016)	-0.13	76	-0.13074	0.11704
13	(Karuniawati, 2017)	0.84	67	1.22117	0.12500
14	(Isnayasari, 2018)	0.032	80	0.03201	0.11396

Based on Table 1, it can be shown that the value of the correlation measure r in 14 (fourteen) research papers varies in the weak, medium, and strong categories. In addition to the relationship measured by positive correlation, there is also a measure of relationship with negative correlation. A positive correlation is a unidirectional relationship that means if Self Regulated Learning (SRL) increases, the level of student mastery also increases. Conversely, a negative correlation is a relationship that is in the opposite direction, namely if Self Regulated Learning (SRL) increases, the level of student mastery decreases.

Table 1 also presents the effect size value, which is in the range of -0.13074 to 1.22117, while the standard error effect size value is obtained in the range of 0.06804 to 0.24254. The effect size value and standard error effect size of each research result are used as the basis for data analysis using the Meta Correlation Analysis procedure.

Results of Meta Anlalysis

The meta-analysis begins by selecting the effect size measurement model through heterogeneity of variance testing. It can be seen that the research data as many as 14 (fourteen) article titles have varying relationship measurement coefficients. This is shown in the results of the variance of residual heterogeneity test, where the Glejser test statistical value is greater than the distribution value at the degree of freedom 13 and the p-value < 0.0001 (it is less than the significance level of test 0.05). This indicates that 14 (fourteen) research results are heterogeneous in variance.

By proving that the variance of research data is heterogeneous, the Random Effect Model is the right model to use in the analysis, one of the models is the DerSimonian-Laird method. This method was used to estimate the average Effect Size of 14 research results and obtained an estimated value of 0.404. The calculation of the 95% confidence interval produces confidence limits in the range of 0.243 to 0.564, where this range contains positive values. Visualization of the Effect Size and Summary Effect values from each study is presented in the form of a Forest Plot [Figure 1](#).

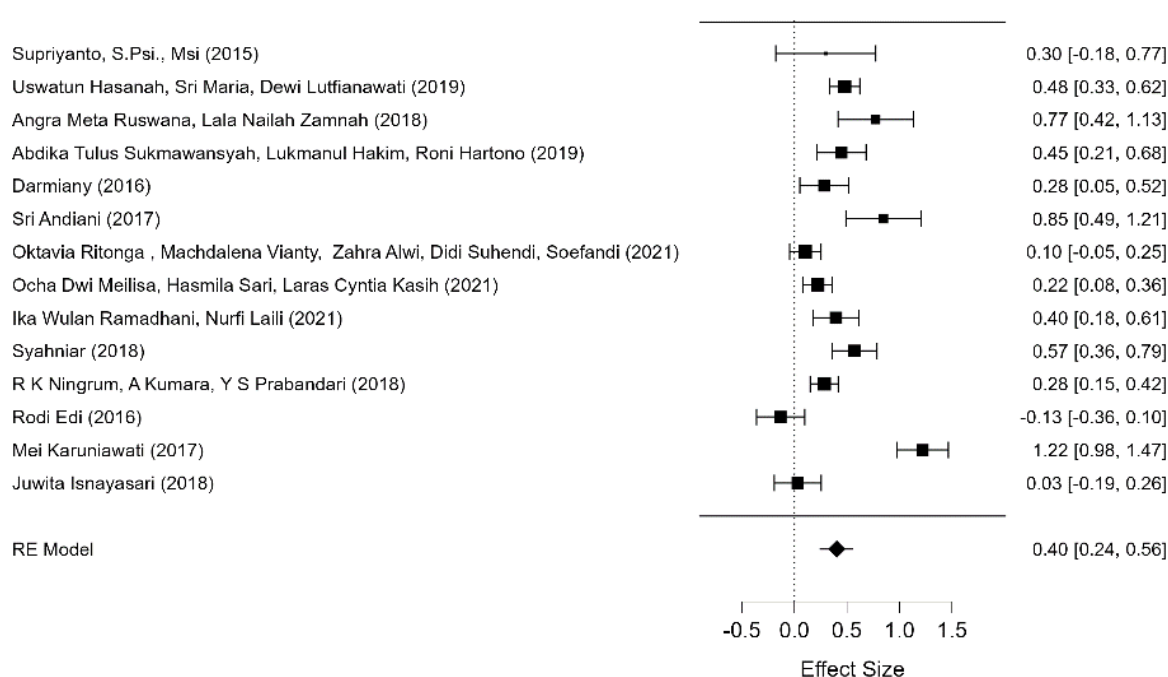


Figure 1. Forest Plot of research data using the Random-Effect Model

Based on the Forest Plot in [Figure 1](#), the results of the Effect Size value of 14 (fourteen) research results show a value close to the Summary Effect result of 0.40 with a range of 0.24 to 0.56. The Effect Size value of the analyzed research shows a varied value, which is between the ranges of -0.13 to 1.22. Most of the data boxplots are to the right of the effect size 0 upright line, which indicates that the dominant research results produce a positive correlation coefficient range. Only one study written by [\(Edi, 2016\)](#) provides a range that tends to be negative. Visually, it can be concluded that the research results tend to show a positive effect. To be sure, the meta-analysis stage will be carried out in the following section.

The Meta-Analysis stage begins by transforming the weighted average effect value (M^*) into the form of the Correlation coefficient value (r^*). Transformation of the weighted average effect value (M^*) into the form of the Correlation Coefficient value (r^*) obtained a value of 0.498 which indicates a "Medium" level of correlation. Transformation

of the confidence interval (M^*) results in a range of values from 0.284 to 0.613. The range does not contain zero or the correlation is at positive values, which indicates a positive relationship between the two variables, SRL and student mastery level. This means that an increase in self-regulated learning will be followed by an increase in the level of student mastery in learning. This is in line with research (Sari & Hardini, 2020) which states an identical conclusion. In contrast to the results of research (Wardani, Munir, Lestari, & Anam, 2023) which produced a negative correlation between self-regulated learning and students' grammar achievement in English language learning.

The Funnel Plot is drawn on a cartesian plane, where the flat axis shows the Effect Size value and the upright axis shows the Standard Error value obtained from the results of the analyzed studies. The center line shows the symmetry axis of the Summary Effect distribution of the observed studies. Meanwhile, the scatter points in the Funnel Plot show the distribution of the Effect Size value against the Standard Error. Funnel Plot is used to visually detect the presence of Publication Bias. If there is no Publication Bias then the Funnel Plot forms a symmetrical point distribution, otherwise there is Publication Bias. The Funnel Plot in Figure 2, shows that there are 8 (eight) points to the left of the symmetry axis and 6 (six) points to the right. At first glance, it can be said that the data is relatively symmetrically distributed. However, drawing this conclusion is not easy because it is only a subjective visual conclusion. So it is necessary to conduct a formal test, namely Egger's Test to complete the conclusion about data distribution.

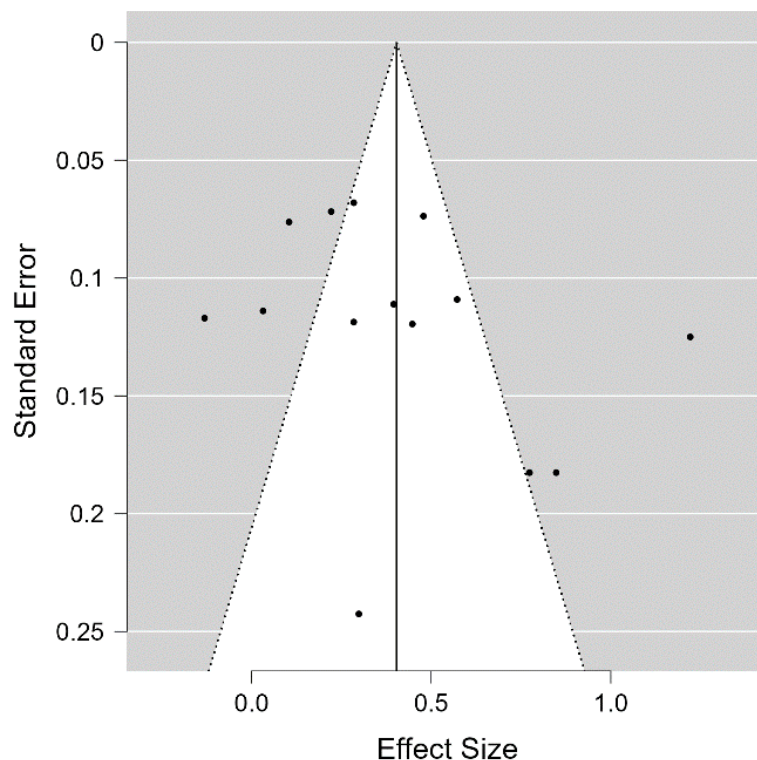


Figure 2. Funnel Plot of research data using the Random-Effect Model

Egger's Test results in a z value of 1.385 and a p-value of 0.166. The p-value is greater than $\alpha = 0.05$, leading to the conclusion that there is no Publication Bias in the research data. Based on Table 2 which presents the heterogeneity estimate, it is known that the value I^2 has an estimate value of 88.057%. The value I^2 which is greater than 25% and close to 100%, indicates that the "true" Effect Size value in all studies tends to be homogeneous (Retnawati, 2018). By proving that the results are homogeneous both graphically and through formal tests, it can be concluded that there is a positive relationship between SRL and students' mastery level. The correlation coefficient of

0.498 shows a relationship at a moderate level, where an increase in Self Regulated Learning motivation will be followed by an increase in ability of student of the material studied.

Table 2. Heterogeneity estimation of research results

Estimation	Confidence Interval of 95%	
	Lower Bound	Upper Bound
τ^2	0.078	0.306
τ	0.280	0.553
I^2 (%)	88.057	96.650
H^2	8.373	29.852

CONCLUSIONS

The meta-analysis conducted on the fourteen observed research results showed the same or similar conclusion, which was that there was a statistically significant effect of Self Regulated Learning (SRL) on Student Mastery Level. Visual and formal testing shows that there is no publication bias in these studies. The level of relationship between the two variables is 0.498 which falls into the medium category. In general, it can be stated that Self Regulated Learning (SRL) has a real positive influence on the level of student mastery. The greater the motivation to learn independently, the better the students' academic mastery.

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