

## Exploring the Impact of Discovery Learning and Self-Efficacy on Students' Critical Thinking Skills

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### ABSTRACT

Critical thinking is a crucial skill for academic and lifelong success, requiring educational strategies that actively engage students. The Discovery Learning model, rooted in constructivist theory, has been widely recognized for promoting higher-order thinking. This study investigates the effects of the Discovery Learning model and students' self-efficacy on critical thinking skills, including the interaction between these variables. A quasi-experimental design was employed involving 60 first-semester students from the Indonesian Language Department. Participants were assigned to either an experimental group (Discovery Learning) or a control group (Problem-Based Learning). Self-efficacy levels were measured using a validated questionnaire, while critical thinking was assessed through a standardized test. Data were analyzed using two-way Analysis of Variance (ANOVA). The results showed that the Discovery Learning model significantly improved students' critical thinking skills ( $F = 27.409, p < 0.001$ ). Self-efficacy also had a significant main effect on critical thinking performance ( $F = 46.780, p = 0.010$ ). Additionally, a significant interaction was found between the instructional model and self-efficacy ( $F = 5.187, p = 0.027$ ), indicating that the impact of Discovery Learning was stronger among students with higher self-efficacy. These findings highlight the combined importance of instructional strategies and learner beliefs. Discovery Learning not only enhances critical thinking but also synergizes with self-efficacy to optimize student performance. Educators are encouraged to implement learner-centered approaches that foster both cognitive skills and student confidence.

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## 1. INTRODUCTION

The Discovery Learning model highlights students' active participation in the learning process, primarily through activities such as experimentation and problem-solving. Within this framework, the teacher assumes the role of a facilitator, providing guidance and support as learners engage with and explore the subject matter. Drawing on constructivist learning theory, this approach assumes that

knowledge develops through individuals' active involvement in experiential and reflective activities, as opposed to being delivered in a passive manner

The Discovery Learning model encourages learners to take an active role in the learning process and is broadly acknowledged as an instructional strategy founded on constructivist principles (Siregar et al., 2020; Rahmadhani et al., 2020; Ruslan et al., 2021). In this approach, learners are encouraged to actively construct their own understanding, while instructional activities are systematically designed to optimize students' exploratory abilities (Ramadhani et al., 2022; Dyamayanti et al., 2023).

The application of Discovery Learning in education offers several benefits, including: (1) Building deeper understanding: Students achieve a more profound understanding when they actively engage in the learning process compared to passively receiving information from teachers, (2) Developing critical thinking skills: By facing challenges and solving problems, students can enhance their critical thinking abilities. Critical thinking is a purposeful, reasoned, and goal-oriented way of thinking applied in decision-making (Yaldiz & Bailey, 2019). These benefits are supported by research findings that indicate the Discovery Learning model can enhance or foster critical thinking skills (Suwardi et al., 2022; Nugraha et al., 2020; Rizki et al., 2021; Mustikaningrum & Mediatati, 2021; Wafa & Jatmiko, 2022; Akhir et al., 2023).

Fostering critical thinking abilities is essential in the educational process, as it significantly contributes to the attainment of learning objectives. Enhancing these skills involves exposing students to multiple perspectives on issues or problems, helping them understand that there is no single approach to problem-solving. Instead, various viewpoints provide valuable insights for deeper comprehension (Dekker, 2020).

Nurturing critical thinking in students goes beyond improving academic performance; it also prepares them for success in life. These skills enable students to gain a more profound understanding of the subject matter by questioning, analyzing, and critically evaluating information, allowing them to grasp complex concepts. The ability to think critically is essential for effective learning and for overcoming challenges they may encounter in the future (Saepuloh et al., 2021). In the current digital age, where information is abundant yet varies in credibility and accessibility, critical thinking is vital for forming sound judgments (Hirai et al., 2022). This competence entails recognizing, evaluating, and logically addressing issues, which supports rational and well-informed decisions.

By thinking critically, students are able to handle and solve problems on their own more effectively. They can identify more critical and efficient solutions and face challenges with a more positive attitude. Furthermore, students with critical thinking skills can evaluate information objectively and distinguish strong arguments from weak ones. This enables them to adopt a more analytical approach to problems and questions. Critical thinking also aids students in constructing strong arguments and communicating their ideas clearly and persuasively (Prahani et al., 2023). Achieving mastery of a subject area effectively demands advanced critical thinking abilities. High-level critical thinking involves (1) Understanding arguments and believing in their validity, (2) Critically evaluating arguments and trusting their credibility, and (3) Developing and defending arguments with strong support (Martaida et al., 2017).

The Discovery Learning model presents challenges, particularly in providing sufficient guidance to students to ensure they remain focused and achieve a correct understanding of the material being studied. Additionally, some studies indicate that Discovery Learning may not be effective in situations where students have limited prior knowledge of the subject or when the material being studied is complex. Therefore, this approach is often more effective when integrated with additional factors and adjusted to accommodate the varied needs and traits of learners.

Beyond the Discovery Learning model, students' self-efficacy is another factor that can strengthen critical thinking skills. Self-efficacy highlights an individual's assessment of their capability to accomplish tasks in particular contexts (Waddington, 2023). It reflects one's belief in their ability to design and implement strategies to overcome academic challenges (Huamán-Tapia et al., 2023). This construct represents how individuals perceive their competencies and their effectiveness in applying them to achieve success (Capron Puozzo & Audrin, 2021). Self-efficacy plays a crucial role in shaping critical thinking, as students with stronger self-efficacy are more likely to demonstrate higher levels of critical

thinking ability (Barli Sihombing et al., 2018). Consistent with this, previous studies have reported a positive association between self-efficacy and critical thinking outcomes (Dehghani et al., 2011).

Critical thinking is regarded as a fundamental skill that fosters creativity, independence, and scientific reasoning. However, developing this skill requires confidence in one's ability to analyze problems, identify relevant solutions, and draw well-supported conclusions. Research findings suggest that students' levels of critical thinking are influenced by their academic self-efficacy (Vachova et al., 2023).

Although prior research has examined the impact of discovery learning on students' critical thinking, little attention has been given to its relationship with self-efficacy. Most studies either focus on discovery learning or self-efficacy as separate constructs, with limited investigation into their combined influence on critical thinking development. Furthermore, moderating or mediating variables that might shape the connection between discovery learning, self-efficacy, and critical thinking have yet to be studied in detail. This research seeks to bridge this gap by conducting a more holistic analysis of these relationships within different educational contexts.

Based on the research framework, three hypotheses are formulated: (1) Discovery Learning demonstrates a positive impact on students' critical thinking, (2) Self-Efficacy exerts a significant positive influence on critical thinking performance, and (3) a notable interaction exists between Discovery Learning and Self-Efficacy in shaping students' critical thinking capacity.

## 2. METHODS

### 2.1 Research Design

This research employed a quasi-experimental design involving independent, dependent, moderating, and control variables. Participants were divided into two groups: an experimental group and a control group. The independent variables consisted of the instructional approaches, namely Discovery Learning and Problem-Based Learning. The dependent variable was students' critical thinking ability, moderated by self-efficacy. The experimental group was taught using Discovery Learning, whereas the control group received Problem-Based Learning instruction. The study design followed a non-randomized control group pretest–posttest format (Ary & Razavieh, 2002), also described as a pretest–posttest non-equivalent factorialized control group design within a 2x2 factorial framework (Tuckman, 1999; Cohen, Manion, & Morrison, 2018).

### 2.2 Research Subjects

A random sampling technique was applied to assign students to the Discovery Learning and Problem-Based Learning groups. The sample consisted of 60 participants aged 18–19, divided equally between the experimental and control groups. To ensure statistical validity and feasibility, the groups were balanced, with varying levels of self-efficacy: 14 high and 16 low in the experimental group, and 11 high and 19 low in the control group.

### 2.3 Research Procedure

Experimental research procedures consist of systematic steps undertaken by researchers to examine hypotheses and obtain empirical evidence within a scientific framework. In this study, the procedures included: (1) selecting research subjects randomly (2) Identifying students' self-efficacy by distributing questionnaires, (3) Conducting a pretest on all research subjects to assess their critical thinking skills before being given treatment, (4) Determining experimental and control groups, (5) Conducting research experiments, namely the experimental group was given treatment with the Discovery Learning Model and the control group was given treatment with the Problem-Based Learning Model, dan (6) Providing a posttest to assess students' critical thinking skills after being given treatment with the learning model.

### 2.4 Research Instruments

The instruments employed in this study were divided into two categories: (a) a questionnaire to measure students' self-efficacy and (b) a test to evaluate their critical thinking skills. The self-efficacy instrument consisted of 17 statement items designed to assess students' self-efficacy levels. Each item was rated on a four-point Likert scale, ranging from Strongly Disagree (1) to Strongly Agree (4). Meanwhile,

the critical thinking instrument was used to assess students' critical thinking performance. Prior to implementation, the research instruments were tested for validity and reliability. The reliability analysis of the self-efficacy questionnaire produced a coefficient of  $\alpha = 0.86$ , indicating high reliability since the value exceeded the 0.70 threshold. The validity results showed that the Content Validity Index (CVI) was 0.92 (very valid category). A CVI value  $\geq 0.80$  indicates that the instrument has been assessed by experts and has a high suitability with the concept of self-efficacy. The reliability test of the Critical Thinking Instrument was  $\alpha = 0.81$  (high-reliability category, because the  $\alpha$  value was  $> 0.70$ ) and the validity results showed Kaiser-Meyer-Olkin (KMO) = 0.89 (very good category, ideally  $> 0.70$ )

## 2.5 Data Analysis Technique

Once the required data had been gathered, they were analyzed using statistical procedures consistent with the research design. Given that this study examined two dependent variables, a two-way Analysis of Variance (ANOVA) was employed. As noted by Tuckman (1999), ANOVA allows researchers to evaluate the combined effects of multiple independent variables, with variations in its application depending on the number of variables under consideration. In factorial designs, independent, moderating, and dependent variables are organized as factors. Hypothesis testing in this study was conducted in two stages, namely assumption testing followed by hypothesis testing.

### 2.5.1 Normality and Homogeneity Test

The data analysis method applied in this study was Analysis of Variance. Prior to conducting the analysis, assumption testing was performed to ensure that the required statistical conditions were met. As a parametric statistical technique, ANOVA is based on several assumptions: (1) the samples must be drawn from normally distributed populations; (2) the variances across sample groups must be homogeneous; (3) the data must be measured on an interval or ratio scale; and (4) the samples must be randomly selected (Sugiyono, 2019).

Before carrying out inferential analysis for hypothesis testing, these assumptions were verified using both normality and homogeneity tests. The normality test was conducted using the Kolmogorov-Smirnov test with Lilliefors Significance Correction via the Statistical Package for the Social Sciences (SPSS) for Windows, while the homogeneity test was performed using Levene's test, available in the ANOVA program package. The criteria for determining normal distribution and variance homogeneity were based on a 5% significance level ( $\alpha = 0.05$ ).

### 2.5.2 Hypothesis Testing

Once the assumptions of parametric testing, including normality and homogeneity, have been satisfied, the analysis proceeds with hypothesis testing. At this stage, the study investigated how the Discovery Learning model and Self-Efficacy influence students' critical thinking. The hypotheses were tested through ANOVA, with the factorial design analyzed using SPSS for Windows. Furthermore, ANOVA was employed to investigate the interaction effects between the two independent variables—Discovery Learning and Self-Efficacy on critical thinking skills. The criterion for determining the significance of these effects was set at a 5% significance level ( $\alpha = 0.05$ ), equivalent to a 95% confidence interval.

## 3. FINDINGS AND DISCUSSION

### 3.1 Research Results

To identify the initial capabilities of participants, particularly in reading comprehension, a pretest was administered to both the experimental and control groups. Assessing prior competence is an important step to verify group equivalence prior to treatment. If the pretest reveals no significant difference, the study may proceed in accordance with the research design.

The descriptive data obtained from the pretest, contrasting the Discovery Learning and Problem-Based Learning groups, were analyzed using an independent two-sample t-test with the aid of SPSS software. The results are reported in Table 1.

**Table 1.** Pre-test Data on Students' Critical Thinking Ability

Learning Models	N	Mean	Std. Deviation
Discovery Learning	30	66.59	3.90
Problem Based	30	66.13	3.86

As presented in Table 1, students taught using the critical thinking approach obtained a pretest mean of 66.59 (SD = 3.901), while those in the Problem-Based Learning group scored 66.13 (SD = 3.865). The similarity of these averages indicates that both groups had equivalent critical thinking skills prior to the treatment. Group equivalence was further tested using an independent samples t-test, the results of which are shown in the table below.

**Table 2.** Results of the t-test Analysis (Independent Sample t-test)

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Pretest	Equal variances assumed	.090	.765	.454	57	.652

As shown in Table 2, pretest scores were analyzed using the t-test. Assuming homogeneity of variances, the F-value was 0.090 with a significance of 0.765. The analysis yielded a t-statistic of 0.454 (df = 57, p = 0.652). Since the observed t-value (0.454) was smaller than the critical value from the t-distribution (1.978), the null hypothesis (Ho) was retained. These findings demonstrate that there was no significant difference in critical thinking performance between students taught with Discovery Learning and those instructed with Problem-Based Learning at the pretest level. The descriptive analysis of posttest reading comprehension scores for both groups is presented in the following table

**Table 3.** Summary of Results of Posttest Data Analysis of Critical Thinking Skills

Learning Model	Descriptive Statistics			
	Self-Efficacy	Mean	Std. Deviation	N
Discovery Learning	High	89.26	4.763	17
	Low	86.52	3.654	13
	<b>Total</b>	<b>87.89</b>	<b>8.417</b>	<b>30</b>
Problem-Based Learning	High	82.79	3.893	12
	Low	80.86	3.744	18
	<b>Total</b>	<b>81.82</b>	<b>7.637</b>	<b>30</b>
Total	High	87.89	8.817	29
	Low	81.82	7.637	31
	<b>Total</b>	<b>84.85</b>	<b>16.45</b>	<b>60</b>

Table 3 displays the results of the posttest data analysis for both the Discovery Learning group and the group taught using the Problem-Based Learning model. The table summarizes the mean scores, standard deviations, and sample sizes (N) for each group.

The posttest results for critical thinking among students in the Discovery Learning group revealed that those with high Self-Efficacy achieved a mean score of 89.26, a standard deviation (SD) of 4.763, and a sample size (N) of 17. In contrast, students with low Self-Efficacy obtained a mean of 86.52, an SD of 3.654, and an N of 13. Overall, the combined critical thinking scores for all students in the Discovery Learning group, encompassing both high and low Self-Efficacy participants, yielded a mean of 87.89, SD of 8.417, and N of 30.

Analysis of critical thinking scores within the Problem-Based Learning group showed that students with high Self-Efficacy recorded a mean of 82.79 (SD = 3.893, N = 12), while those with low Self-Efficacy obtained a mean of 80.86 (SD = 3.744, N = 18). When combined, the overall posttest mean for all students in this group was 81.82, with a standard deviation of 7.637 and a total of 30 participants. Overall, the critical thinking performance of students exposed to Discovery Learning and Problem-Based Learning, regardless of whether they had high or low Self-Efficacy, produced a mean score of 84.85 with a standard deviation of 16.45 and a total of 60 participants.

In this study, a normality test was conducted to examine the distribution of critical thinking scores across groups based on (1) instructional models, namely Discovery Learning and Problem-Based Learning, and (2) levels of Self-Efficacy. The Kolmogorov-Smirnov test with Lilliefors Significance Correction was applied at a significance level of  $\alpha = 0.05$ . The null hypothesis ( $H_0$ ) proposed that the sample was derived from a normally distributed population. The decision-making framework was as follows: (1) significance values greater than 0.05 indicated normal distribution, while (2) values lower than 0.05 reflected a deviation from normality. The outcomes of the normality test for students' posttest performance across different reading strategy groups are provided in the subsequent table.

**Table 4.** Results of Post-Test Data Normality Test Based on Learning Models

Critical Thinking Skills	Learning Models	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
	Discovery	.096	30	.200*	.962	30	.340
	Problem Based	.073	30	.200*	.990	30	.991

The Kolmogorov-Smirnov test with Lilliefors correction showed that: (1) the significance value for students' critical thinking scores in the Discovery Learning group was 0.200 ( $> 0.05$ ), and (2) the significance value for those in the Problem-Based Learning group was likewise 0.200 ( $> 0.05$ ). These results suggest that the critical thinking data in both groups followed a normal distribution. In addition, the outcomes of the normality test for posttest scores categorized by students' Self-Efficacy levels (high and low) are presented in the subsequent table.

**Table 5.** Results of Post-Test Data Normality Test Based on Self-Efficacy

Critical Thinking Skills	Self-Efficacy	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
	High	.077	35	.200	.982	35	.822
	Low	.130	25	.200	.972	35	.697

Based on the Kolmogorov-Smirnov test with Lilliefors correction, the significance value for students with high Self-Efficacy was 0.822 ( $> 0.05$ ), and for those with low Self-Efficacy was 0.697 ( $> 0.05$ ). These findings demonstrate that critical thinking scores in both categories adhered to a normal distribution. Furthermore, a homogeneity test was conducted to determine whether the groups under investigation had equal variances. In this study, homogeneity signifies that the distributions being compared possess similar variance properties. The Levene's test, with a significance level of  $\alpha = 0.05$ , was applied to evaluate the equality of variances across Discovery Learning and Problem-Based Learning groups, considering both high and low Self-Efficacy students. The null hypothesis stated that variances among groups were equal. Decisions were made by the following criteria: (1) significance values greater than 0.05 confirm homogeneity, while (2) significance values lower than 0.05 indicate non-homogeneity. The outcomes are summarized in the following table.

**Table 6.** Results of the Critical Thinking Data Homogeneity Test with Levene's Tests

Test of Homogeneity of Variance				
		Levene Statistic	df2	Sig.
Critical Thinking Skills	Based on Mean	0.344	58	0.560

The homogeneity of variance test presented in the table above shows that the Levene test result, based on the mean of critical thinking scores, was 0.344 with  $df2 = 58$  and a significance level of 0.560. Since the significance level of 0.560 is greater than 0.05, it can be concluded that the critical thinking data were homogeneous. Following the normality and homogeneity tests, hypothesis testing was conducted. The hypothesis test examined the critical thinking scores of students who received instruction through the Discovery Learning model and those taught using the Problem-Based Learning model, with both groups further divided into students with high and low Self-Efficacy. The purpose of this hypothesis testing was to evaluate the validity of the proposed research hypotheses, namely: (1) The use of Discovery Learning produces a significant effect on students' critical thinking; (2) Self-Efficacy plays a significant role in enhancing critical thinking; and (3) the interaction between instructional model and Self-Efficacy shows a significant influence on students' critical thinking outcomes.

Hypothesis testing was performed using a two-way ANOVA (factorial  $2 \times 2$ ) supported by SPSS, and the results of the interaction effects are displayed in the following table.

**Table 7.** Results of the Test of the Influence of Individual Variables

Tests of Between-Subjects Effects					
Dependent Variable: Critical Thinking					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	648.102a	3	216.034	26.316	.000
Intercept	420206.226	1	420206.226	51186.729	.000
Learning Models	225.007	1	225.007	27.409	.000
Self-Efficacy	384.032	1	384.032	46.780	.000
Model * Self-Efficacy	42.584	1	42.584	5.187	.027
Error	429810.170	56	8.209		
Total	429810.170	60			
Corrected Total	1107.822	59			

a. R Squared = .585 (Adjusted R Squared = .563)

The two-way ANOVA analysis on critical thinking ability (Table 7) demonstrates that the Discovery Learning model exerted a statistically significant influence, with an F-value of 26.316 at a significance level of 0.00 ( $< 0.05$ ). This result confirms that instructional strategies based on Discovery Learning can substantially strengthen students' critical thinking capacity. Moreover, the descriptive data in Table 7 highlight differences in score improvements across groups. Specifically, the Discovery Learning group showed a mean score increase of 21.30 points from pretest to posttest, while the Problem-Based Learning group recorded an increase of 15.69 points. The greater improvement observed in the Discovery Learning group provides evidence that this instructional approach is more effective in developing students' critical thinking skills.

As presented in Table 7, the analysis indicates that self-efficacy has a significant effect on students' critical thinking, with an F-value of 46.780 and a significance level of 0.010 ( $< 0.05$ ). Likewise, Table 4.9 reveals that the interaction between learning model and self-efficacy produced an F-value of 5.187 with a significance level of 0.027 ( $< 0.05$ ). These outcomes indicate that not only does self-efficacy

independently affect critical thinking, but its interaction with instructional models also contributes significantly to enhancing students' critical thinking skills.

### 3.2 Discussion

Drawing on the results of hypothesis testing, the discussion addresses three key points: the influence of instructional models on students' critical thinking, the role of self-efficacy in shaping critical thinking, and the interaction between instructional models and self-efficacy. The findings reveal that students' critical thinking skills differ significantly between those who were taught through the Discovery Learning model and those instructed using the Problem-Based Learning model. Overall, students exposed to the Discovery Learning model achieved higher mean scores than their counterparts in the Problem-Based Learning group. This is further supported by the critical thinking test results, where students in the Discovery Learning group obtained an average score of 87.89

Students exposed to the Problem-Based Learning approach obtained an average score of 81.82. The findings suggest that Discovery Learning is more effective in enhancing student outcomes. Hypothesis testing confirmed this, yielding an F-value of 27.40 with a significance level of 0.00 ( $<0.05$ ), demonstrating that the choice of learning model significantly impacts students' critical thinking. The superior performance of Discovery Learning can be attributed to its promotion of active engagement, critical analysis, and autonomous problem-solving, which collectively foster students' critical thinking development.

Within the Discovery Learning framework, students encounter open-ended problems or questions that demand logical reasoning, critical evaluation of information, and the development of appropriate solutions. This process trains students to identify problems, understand various perspectives, and determine the best approach. In addition, the Discovery Learning Model develops analytical skills. In this case, students are asked to collect, organize, and evaluate relevant data. This activity trains them to analyze relationships, and cause and effect, this kind of activity encourages the formation of critical thinking skills. In other words, this process involves in-depth analysis, evaluation of information, and synthesis of ideas, all of which strengthen critical thinking skills.

The findings of the current study are in line with earlier investigations. Previous evidence demonstrated that the Discovery Learning model effectively fosters students' critical thinking as well as their overall learning performance (Cintia et al., 2018). Classroom Action Research further revealed notable progress, with critical thinking scores increasing from 38% in the pre-cycle to 73% in the first cycle and 81% in the second cycle. Similarly, learning outcomes improved from 35% at the pre-cycle stage to 77% in the first cycle and 85% in the second cycle (Prasasti et al., 2019). Consistent with these results, further studies also validated the substantial role of Discovery Learning in advancing students' thinking skills (Prasasti et al., 2019; Laeni & Efwinda, 2022; Fahmi et al., 2023).

Another factor contributing to students' critical thinking ability is self-efficacy. Self-efficacy plays a crucial role in shaping an individual's thinking skills. The hypothesis testing in this study revealed an F-value of 46.780 with a significance level of 0.010 ( $<0.05$ ), confirming that self-efficacy significantly influences students' critical thinking. This influence can be explained by the role of self-efficacy in guiding how students organize their thoughts and strategies when solving problems. Learners with stronger self-belief tend to approach problems in a more structured manner. Within the learning context, self-efficacy fosters greater engagement in discussions and problem-solving activities, both of which are essential for developing critical thinking skills. Students with high levels of self-efficacy are generally more confident in dealing with complex tasks or challenges that require critical reasoning. Hence, there is a clear relationship between self-efficacy and students' critical thinking skills (Aydin Gürler, 2021; Azizah et al., 2022; Vachova et al., 2023).

Empirical findings demonstrate that self-efficacy plays an important role in shaping students' cognitive and motivational outcomes. For instance, it not only contributes to the development of critical thinking but also supports students' learning motivation (Arjun Yoga Pratama, 2023). Evidence from Salea et al. (2022) further reveals a significant positive correlation, suggesting that individuals with high

self-efficacy tend to display stronger critical thinking skills. In agreement with this, Umam et al. (2023) reported that students with higher levels of self-efficacy consistently outperform those with lower self-efficacy in critical thinking performance. Moreover, Karaođlan-Yilmaz et al. (2019) showed that self-efficacy enhances metacognitive skills, thereby reinforcing the cognitive mechanisms underlying critical thinking.

The Discovery Learning Model with self-efficacy has an interactive effect. The results of the hypothesis test of this study, show that the F count value for the interaction of the learning model with Self-Efficacy contained in Table 4.9 is 5.187 with a probability or significance value of  $0.027 < 0.05$ . This means that there is an interaction effect between the learning model and self-efficacy on students' critical thinking skills. The factor causing the interaction effect is that the Discovery Learning-based learning design can stimulate the development of students' self-efficacy, which in turn contributes to improving their critical thinking skills (Prasetya, 2022).

Another factor underlying the interaction between the Discovery Learning model and self-efficacy is the ability of this model to foster an active and interactive learning environment in which students are encouraged to explore and construct knowledge independently. The Discovery Learning approach places learners in problem-solving situations that stimulate critical thinking (Rahmawati et al., 2021). Through engagement in the discovery process, students develop the capacity to evaluate information, draw inferences, and formulate conclusions based on evidence. Furthermore, learners with higher levels of self-efficacy are generally more confident in tackling challenging tasks, which further supports the effectiveness of discovery-based learning.

The mastery of learning tasks can reinforce students' self-efficacy, which in turn facilitates the growth of their critical thinking abilities. When learners perceive themselves as competent, they are more inclined to contribute actively in academic discussions, share diverse perspectives, and collaborate effectively with peers—activities considered central to the cultivation of critical thinking (Simamora et al., 2018). Within this context, the Discovery Learning model proves effective in promoting critical thinking, especially when students are exposed to problem-based activities that require creative and analytical solutions (Yuniawati & Purba, 2021). Furthermore, students with higher levels of self-efficacy tend to demonstrate greater initiative and autonomy in the learning process, thereby strengthening the development of their critical thinking skills. Taken together, the combination of Discovery Learning and high self-efficacy establishes a mutually reinforcing relationship that optimizes students' critical thinking capacity.

#### 4. CONCLUSION

The findings of this study demonstrate that the Discovery Learning model significantly enhances students' critical thinking skills ( $F = 27.409, p < 0.05$ ), with self-efficacy also exerting a meaningful influence ( $F = 46.780, p < 0.05$ ), and a significant interaction observed between instructional model and self-efficacy levels ( $F = 5.187, p < 0.05$ ), indicating that students with higher self-efficacy benefit more from Discovery Learning. However, the research is limited by its focus solely on instructional models and self-efficacy, excluding potentially influential factors such as learning motivation, environmental support, or individual differences. Additionally, the quasi-experimental design provides only a short-term view, limiting insights into the sustained impact of these variables. Future research should consider a broader range of moderating variables—including learning strategies, engagement levels, and social context—and adopt longitudinal approaches to better understand the long-term development of critical thinking skills. These results underscore the need for educators to integrate learner-centered strategies like Discovery Learning with efforts to build students' academic confidence to foster critical, independent thinking in diverse classroom settings.

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