



Correlation of self-efficacy, social support, and learning interest with students' metacognitive skills in biology learning



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ABSTRACT

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Metacognitive skills are a person's ability to manage cognition and make decisions to solve problems. Therefore, this study aims to determine the relationship between self-efficacy, social support, and interest in learning biology with students' metacognitive skills. This type of research uses the ex-post facto method with a quantitative approach. The research sample consisted of 271 students of class XI of a public high school in Tamalate District, Makassar City. The research instruments were questionnaires and essay questions. Data were analysed by path analysis using IBM SPSS Statistics 29.0 for Windows. The results of study indicate that self-efficacy has a relationship with interest in learning biology, social support has a relationship with interest in learning biology, self-efficacy has a relationship with metacognitive skills, social support has a relationship with metacognitive skills, interest in learning biology has a relationship with metacognitive skills, self-efficacy has an indirect relationship (through interest in learning biology) to metacognitive skills, social support has an indirect relationship (through interest in learning Biology) to students' metacognitive skills. Based on the research findings, it is known that many aspects can affect metacognitive skills, so it is necessary to consider the empowerment of metacognitive skills seriously.

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INTRODUCTION

Education has an important role in shaping quality human resources. The quality of human resources is seen from the success of education in schools (Adnan and Bahri, 2018). One of the steps that can be taken to improve the quality of education is to empower students' competencies, such as thinking skills. (Sodik, et al. 2019). One of the important thinking skills is metacognitive skills. Metacognitive skills are part of thinking skills (Bahri, et al. 2019) and include 21st-century



education targets. Based on empirical findings in Bahri et al. (2018) that the lack of metacognitive empowerment of students has implications for students' cognitive abilities, which tend to be low. This is supported by Bahri & Corebima (2015) research has shown that metacognitive skills are one aspect of the dimensions of knowledge and skills that are important to be studied further.

Metacognition is an important indicator that helps students find out information that has not been understood, and create learning independence (Heyes et al. 2020, Boer et al. 2018) build the right concepts and choose learning strategies (Antika, et al. 2022) in a way that is essential for effective learning in complex situations (Indra et al. 2018). Bandura (1994) stated that when individuals have a high level of metacognitive awareness, individuals are more able to set goals and adjust learning strategies. Metacognitive skills are essential for knowledge integration and accumulation while serving as important predictors of engagement in learning, gives to obtain better results. Wang et al. (2021) metacognitive skills are essential for knowledge integration and accumulation while serving as important predictors of engagement in learning.

Research on metacognitive skills has been carried out, but it is still rare to discuss social support factors, especially from peers and student interest in learning, which can have a positive influence on metacognitive skills. This study examines metacognitive skills by looking at factors that are considered to influence metacognitive skills both internally and externally. The achievement of students' metacognitive skills is a factor of self-efficacy. Bandura (1994) defines efficacy refers to an individual's belief in his ability to achieve goals. This is closely related to the influence of the surrounding environment that provides social support, especially from peers. Peer social support provides opportunities to interact, be able to control social behavior, and exchange solutions in solving problems that have an impact on increasing student interest in learning (Jenira, 2019). Interest has an important role in learning activities (Nugroho, et al. 2020), interest is a factor that comes from within students. which is an aspect of behavior that tends to lead to positive things (Fansuri, et al. 2022). Interest in learning encourages students to carry out activities that will give birth to positive activities in terms of attitudes, skills, and knowledge.

Based on the facts in the field obtained from public high school biology teachers in Tamalate District, Makassar city, that there are still among students who when the learning process takes place are considered to have understood the concept of the material studied and can solve the problems given, but when the exam takes place they have difficulty working on it. So that researchers see that this research is important to do. The results obtained are expected to improve student competence which will have an impact on improving metacognitive thinking skills.

RESEARCH METHODS

Research Design

The research method applied is quantitative with the type of *ex post facto* research that is double correlation. *Ex post facto* research is a form of research by looking at phenomena that have occurred before then identifying the relationship between variables. The research design applied in this study is *path analysis*. Details of the research design in Figure I.

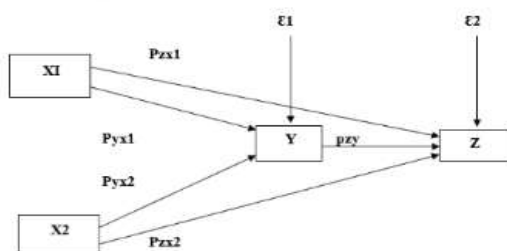


Figure I. Design-Research Flowchart

Population and Samples

The population of this study included all high school grade XI students in the Tamalate sub-district, Makassar City, who were enrolled in the 2024/2025 academic year and consisted of 3 schools. The sample in this study totaled 271 students. The sampling technique used was *simple random sampling*, allowing each member of the population to have the same opportunity to be selected as part of the sample without regard to the strata in the population.

Instruments

The instruments used in the study were questionnaires consisting of 25 questions each and test instruments in the form of essay questions consisting of 10 questions. Questionnaires are used to obtain scores for each variable. According to Bandura (1994) self-efficacy includes indicators (*level, generality, and strength*). social support includes indicators (emotional support, instrumental, information, and appreciation). According to Keller (1997), learning interest includes indicators (feelings of pleasure, interest, acceptance, and involvement. essay test questions are used to obtain metacognitive skills scores. According to Majed (2023), includes indicators (*planning, monitoring, evaluating, and revising*) have been validated by experts. The validation results of the four instruments were 1.0, with a very valid category. While the results of the reliability test of the self-efficacy instrument are 0.755, social support 0.877, interest in learning 0.846, and metacognitive skills 0.657.

Procedures

The procedure of this research is divided into 4 stages: the planning stage, the pre-research stage, the research implementation stage, and the final research stage. The planning stage consisted of observations and interviews with biology teachers. Furthermore, the pre-research stage is the preparation of a research proposal, the preparation of research instruments, and the validation of research instruments. Then, the research implementation stage is data collection at the school by distributing questionnaires and questions to students. The final stage of the research is the analysis of data obtained from the questionnaire scores of self-efficacy, social support, and interest in learning biology, and the value of metacognitive skills essay questions.

Data Analysis

Data were analysed using IBM SPSS *Statistics 29.0 for Windows*, which included descriptive analysis and inferential analysis. Before conducting path analysis, prerequisite tests were carried out, which include normality test, linearity test, multicollinearity test, and heteroscedasticity test, then hypothesis testing, namely simple regression analysis, multiple regression analysis, and path analysis.

RESULTS

The following descriptive analysis results of self-efficacy, social support, interest in learning biology, and metacognitive skills are presented in Figure 2.

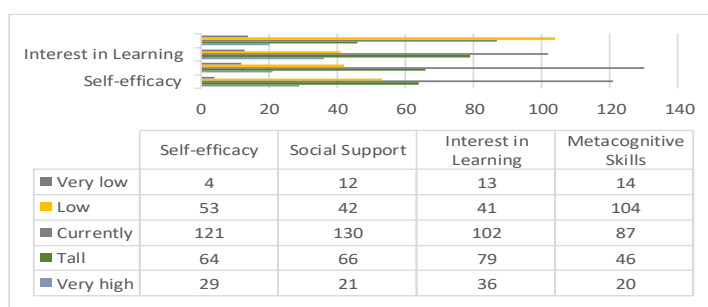


Figure 2. Diagram of levels of self-efficacy, social support, interest in learning, and cognitive skills

The results of the data normality test calculation obtained through the *one-sample Kolmogorov-Smirnov* test, obtained an *Asymp. Sig (2-tailed)* of 0.200, this value indicates that this study is normally distributed. The results of the linearity test calculation obtained a *linearity sig.* value of 0.001, meaning that there is a linear relationship between the variables. The results of calculating the multicollinearity test, obtained the *tolerance* value on the self-efficacy variable = 0.471 and the VIF value on the self-efficacy variable = 2.125 *tolerance* value on the social support variable = 0.761 and the VIF value on the social support variable = 1.314 *tolerance* value on the biology learning interest variable = 0.454 and the VIF value on the learning interest variable = 2.202. This value indicates that there is no multicollinearity problem. The results of the heteroscedasticity test obtained a value for self-efficacy *sig.* of 0.526 for social support *sig.* value of 0.255 and interest in learning biology obtained *sig.* value of 0.553. This value indicates that there is no heteroscedasticity problem.

Substructural I

In substructure I, the relationship between self-efficacy (X_1) and social support (X_2) with interest in learning biology (Y) was analyzed. The results of the calculation of substructural path I can be seen in Table I.

Table I. Recapitulation of Substructure I results

Independent Variables	R ²	Standardized Coefficient	T	Sig. Coefficients
X1	.546	.636	13.900	<0.001
X2		.190	4.156	<0.001

The coefficient of determination (R^2) is 0.546, meaning that self-efficacy and social support contribute 54.6% to interest in learning biology, while the rest is influenced by other variables. The path coefficient value on substructure-I, namely the path coefficient of X_1 on Y (ρ_{yx1}) = 0.636, the path coefficient of X_2 on Y (ρ_{yx2}) = 0.190. because the Sig value <0.05, then H_0 is rejected, which indicates that the result is significant. This indicates that self-efficacy provides changes in interest in learning biology by 0.636 or 63.6%. Meanwhile, the peer social support variable (X_2) provides a change in interest in learning biology by 0.190 or 19.0%. The value of ϵ_1 can be known by the formula $\epsilon_1 = \sqrt{(1 - R^2)}$, $\epsilon_1 = 0.673$. Visualization of the path coefficient value and error in substructure I can be seen in Figure 3.

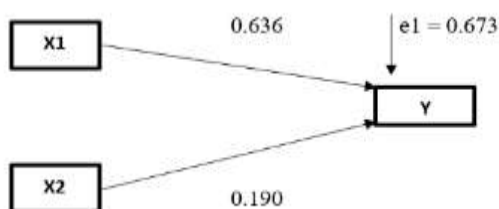


Figure 3. Substructure I Path Diagram

Based on the path coefficients that can be seen in Figure 3. Then the regression equation in substructure I is obtained, namely:

$$\hat{Y} = 0.636X_1 + 0.190X_2 + 0.673$$

Substructure II

In substructure II analysed the relationship of self-efficacy (X_1), social support (X_2), and interest in learning biology (Y) with metacognitive skills (Z). The results of the calculation of substructure II can be seen in Table 2.

Table 2. Recapitulation of Substructure II results

Independent Variables	R^2	Standardized Coefficient	T	Sig. Coefficients
X1	.410	.444	6.478	<0.001
X2		.158	2.926	<0.004
Y		.138	1.997	<0.049

The coefficient of determination (R^2) is 0.410, meaning that self-efficacy, social support, and interest in learning have a contribution of 41.0% to metacognitive skills, while the rest is influenced by other variables. The path coefficient value on substructure-II is the path coefficient X1 to Z (ρ_{yx1}) = 0.444, the path coefficient X2 to Z (ρ_{yx2}) = 0.158, and the path coefficient Y to Z (ρ_{zy}) = 0.138. obtained each significance value <0.05, then H_0 is rejected, so it is said to be significant. This shows that self-efficacy provides a change in metacognitive skills of 0.444 or 44.4%. The peer social support variable (X_2) provides a change in metacognitive skills of 0.156 or 15.6%. Biology learning interest variable provides a change in metacognitive skills of 0.138 or 13.8%. The value of ϵ_2 can be known by the formula $\epsilon_2 = \sqrt{1 - R^2}$, $\epsilon_2 = 0.768$. Visualisation of the path coefficient value and error on substructure II can be seen in Figure 4

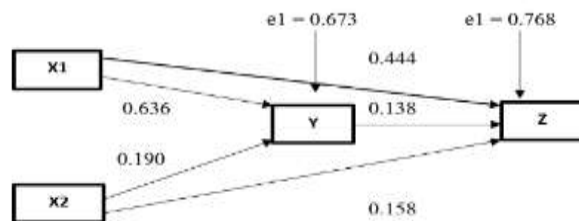


Figure 4. Substructure II path Diagram

Based on the path coefficients that can be seen in Figure 4. Then the regression equation in substructure II is obtained, namely:

$$\hat{Y} = 0.444X_1 + 0.158X_2 + 0.138 + 0.768$$

Furthermore, the calculation of direct and indirect relationships and the total relationship of efficacy variables and peer social support with metacognitive skills through interest in learning biology can be seen in Table 3.

Table 3. Direct relationship, indirect relationship, and total relationship of self-efficacy and social support variables with metacognitive skills

Variabels	Relationship directly	Relationships are not directly	Total Influence
Self-efficacy	0.444	0.087	0.531
Social Support	0.158	0.026	0.184
Total	0.602	0.113	0.715

Based on the results of the calculation, it is known that the direct relationship value of self-efficacy (X_1) to metacognitive skills (Z) is 44.4% and the indirect effect of self-efficacy with metacognitive skills is 8.7%. The value of the direct relationship of social support (X_2) with metacognitive skills (Z) is 15.8% and the indirect effect of peer social support with metacognitive skills through interest in learning biology is 2.6%. Thus, self-efficacy and social support can affect metacognitive skills directly and indirectly. So that metacognitive skills have a relationship with self-efficacy and social support directly by 60.2%, meaning that 35.8% is influenced by other factors. Metacognitive skills have a relationship with self-efficacy and social support as a whole (directly and indirectly) of 71.5%.

DISCUSSION

The direct relationship of self-efficacy with interest in learning

The results of the study indicate, there is a significant and positive relationship between self-efficacy and interest in learning biology in class XI students of public high schools in Tamalate District, Makassar City. This positive relationship shows that the higher the self-efficacy, the higher the students' interest in learning biology. This finding shows that students' self-efficacy has an important role in students' interest in learning biology. The findings of this study are consistent with the research conducted by Seon Ahn & Bong (2019) that self-efficacy and interest are strongly correlated, which indicates that self-efficacy becomes an important prerequisite for increasing interest in learning.

Likewise, the findings of Sucityaswati & Herwina (2024) that efficacy is the most important factor in the realisation of the study. Self-efficacy has a positive and significant effect on students' interest in learning. Students can complete challenging tasks by using the self-directed learning strategies effectively, and are able to process lower levels of learning anxiety (Bandura, 1977). Diperkuat oleh Wei *et al.* (2022), Reinforced by Wei *et al.* (2022) in their research, identified self-efficacy as one of the strongest predictors of student academic performance. Schweder, (2022) efficacy and interest in learning are 2 key components that encourage students in learning.

The direct relationship between social support and students' interest in learning

The results of the study indicate, a significant and positive relationship was found. This study investigated the relationship between social support and students' interest in learning biology in class XI of public high schools in Tamalate District, Makassar City. The findings of this study suggest that peer social support plays a significant role in boosting students' interest in learning biology. As stated by Madriz & Konishi (2021), Students who receive greater social support from peers tend to show greater academic engagement. In line with the research conducted by Dwi & Eko (2022), there is a significant relationship between social support, peer social support, with interest learning. This indicates that positive peer social support can have a positive impact on student interest in learning. Research by Lim and Lee, (2020) also found that the level of peer relationships at school has a significant influence on academic engagement.

Students can serve as a more productive and positive resource for each other in the classroom (Cappella *et al.* 2013). A connected and inclusive environment can create a safe space to engage in learning activities (Lee & Lee (2023). Peer relationships in early adolescence are emphasised as an important factor influencing student behaviour (Lan & Radin, 2020) togetherness among students at school has a positive impact on students' academic achievement (Yoo & Park, 2020) Positive school climate is formed through bonding with peers, with a safe school environment, and encouraging positivity in their learning (Schwabe, *et al.* 2019). The quality of relationships

between students and their peers is believed to play a crucial role in enhancing their academic engagement, creating a positive psychological environment at school.

Direct relationship of self-efficacy with students' metacognitive skills

The results of the study indicate, there is a significant relationship between efficacy with metacognitive skills of students in grade XI of public high schools in Tamalate District, Makassar City. The positive relationship indicates that the higher the self-efficacy then the higher the students' metacognitive skills. Research results reveal that self-efficacy plays an important role in improving students' metacognitive skills. Various studies have shown that self-efficacy and metacognitive strategies have a positive correlation and have conceptualised self-efficacy as a significant predictor of self-directed learning strategies that include metacognitive aspects (Tembo, 2016). In line with the research of AL-Baddareen *et al.* (2015), There is a strong correlation between *self-efficacy* and metacognitive skills. The results of research by Dwiyanti *et al.* (2021) also showed a significant positive relationship between self-efficacy and metacognitive skills. Research (Hayat & Shateri, 2019) reinforces these findings by showing that self-efficacy has a positive and significant relationship with metacognition. Strong self-efficacy influences students' thinking and behavior, shaping their effort and persistence in learning. In summary, students with higher levels of self-efficacy are generally more successful in applying metacognitive strategies.

The relationship of social support with students' metacognitive skills

The results of the study indicate, there is a significant relationship between social support and students' metacognitive skills. There is a positive relationship between peer social support and metacognitive skills of students in grade XI of public high schools in Tamalate District, Makassar City. This positive relationship indicates that the higher peer social support, the higher students' metacognitive skills. This research reveals that peer social support has an important role in improving metacognitive skills. Students who receive high social support tend to have positive thoughts in facing difficulties in learning (Oktariani, *at al.* 2020). In line with research Carvalho & Santos (2022), which shows that social support contributes positively to metacognitive skills, so that students can manage learning activities independently, improve communication and collaboration skills, and achieve optimal results (Care *et al.* 2016).

Direct relationship of learning interest with metacognitive skills

The results of the study indicate, there is a significant relationship between interest in learning and students' metacognitive skills. learning with metacognitive skills of students in class XI of State Senior High School in Tamalate District, Makassar City and has a positive value. The results showed that interest in learning has an important role in improving metacognitive skills. metacognitive skills. However, in this study, students' metacognitive skills were still relatively low; this should be a concern for teachers to improve students' metacognitive skills, one of which is by providing encouragement or presenting interesting learning strategies that can increase students' interest in learning. An observational study showed that teachers who provided metacognitive support in their teaching had students who showed higher growth than students in classes with lower or no metacognitive support (Zepeda *et al.* 2019)

Research conducted by Silmi & Lestari (2024) shows that interest in learning has a strong relationship that has a positive and significant impact on metacognitive skills. Research by Andini & Azizah (2021) explains that metacognitive skills and interest in learning have a positive and significant effect on student learning outcomes, which means that students' metacognitive awareness is directly proportional to their learning outcomes. Ask to learn and metacognitive skills synergize or balance each other. Students with low metacognitive skills may maintain engagement if

they have high interest, or students with low interest may remain engaged because they have strong metacognitive skills (Wang *et al.* 2021).

The relationship between self-efficacy and metacognitive skills through interest in learning

The results of the study indicate, self-efficacy has no relationship with metacognitive skills, directly with metacognitive skills through interest in learning biology. This means that the higher the self-efficacy, the higher the metacognitive skills through students' interest in learning biology. Ngatno (2015) explains that the mediator variable is between the independent and dependent variables, so that the independent variable does not directly affect the dependent variable; in this case the learning interest variable bridges the relationship between the self-efficacy variable and metacognitive skills. interpreted that students who have high self-efficacy have high metacognitive skills because they have a good interest in learning biology. In line with research Koyuncuoglu (2023) that students who have confidence in their abilities and believe that they can achieve goals will be encouraged in their interests by approaching learning with a more positive and determined attitude, which leads to increased academic success.

Students act based on their beliefs about their abilities and beliefs about the results that will be obtained (Bandura 2010). they will be willing to do very difficult tasks when they have high self-efficacy, learning any subject. Nasir & Iqbal (2019). This involves metacognitive skills based on beliefs that generate interest in difficult tasks. Thus, metacognitive aspects are important to be empowered during the learning process (Bahri & Idris, 2018). These findings suggest that self-efficacy in general is mediated by interest in learning, and partly the relationship between metacognitive skills.

The relationship between social support and metacognitive skills through students' interest in learning

The results of the study indicate, peer social support has an indirect relationship with metacognitive skills through interest in learning. The higher the social support of peers, the higher the metacognitive skills through interest in learning biology. This is in line with Nasution (2018) research states that Students are more likely to receive strong support from their peers and feel motivated to learn when they associate with peers who exhibit positive behavior and have a genuine interest in learning. Supported by research, Koyuncuoglu (2023) suggests that individuals can be encouraged or discouraged based on the support provided. Reinforced by the results of research by López *et al.* (2024) that academic engagement is not only obtained from the academic environment, but also from other factors, namely family, teachers, and peers, but involvement in learning is self-regulated, through the process of social support that generates interest and interest in learning. The influence of peers will be more easily accepted as a form of support Slameto (2015). social environment, which is considered to have an important influence on interest and application of knowledge with metacognitive skills (Panadero 2017).

CONCLUSION

Based on the results of the research that has been done, the results show that self-efficacy, peer social support, and interest in learning biology in public high schools in Tamalate District Makassar city are in the medium category, and metacognitive skills are in the low category. Data analysis shows that there is a relationship between self-efficacy and interest in learning. There is a relationship between social support and biology learning interest, there is a relationship between self-efficacy and metacognitive skills, there is a relationship between peer social support and metacognitive skills, there is a relationship between biology learning interest and metacognitive skills, there is a relationship between self-efficacy and metacognitive skills through biology learning

interest, there is a relationship between peer social support and metacognitive skills through biology learning interest. The suggestions that can be given are that efforts are needed to develop self-efficacy, social support, interest in learning biology, and metacognitive skills of students with learning strategies that have the potential to develop this so that it has an impact on better biology learning outcomes.

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