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Metacognitive and creative thinking skills: A post-covid-19 correlational study

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ABSTRACT

The facts of learning in education showed that students were less encouraged to develop metacognitive skills and creative thinking skills, so that students were not active and students were less likely to participate in the learning process. This study aimed to determine the correlation of metacognitive skills with creative thinking skills of class XI students in biology subjects. The subjects of this study were students of class XI A IPA at MA Miftahul Ulum Nagasari Congkop in the second semester of academic year 2021/2022, totaling 24 students. This research is quantitative research with regression correlation analysis technique using SPSS Version 26.0. Collecting data on metacognitive skills and creative thinking skills using a rubric that was integrated with an essay test. The results of this study indicated that there was a significant relationship between metacognitive skills and creative thinking skills. Results of the regression analysis showed a large R value of 0.616 which indicated that there was a strong relationship between metacognitive skills and creative thinking skills. The guided inquiry model is the recommended model in empowering metacognitive and creative thinking skills, especially in learning biology.

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INTRODUCTION

Education is the development of an intellectual paradigm, in this paradigm students are expected to have mental readiness and theoretical readiness to experience an ever-changing life. Education can also be part of an instrument to build and nurture the nation's personality, strengthen national identity and strengthen national identity (Kadi *et al.*, 2017). Education is a conscious and planned effort to create a learning atmosphere and process so that students actively develop potential of having religious spiritual strength, self-control, personality, intelligence, character, and skills needed by themselves, society, nation, and state (UU No.20 2003).

In practice, educational success is closely related to the learning process. Regarding this, the facts showed that there were still many teachers who pay less attention to the learning process and

were not accustomed to using varied learning models, so that students were less focused in the learning process. Until now, the world of education has never been separated from a problem, especially in the learning process, for example online distance learning during the current Covid-19. This condition is related to the number of unprepared students and teachers in learning. Students are required to understand the material themselves without direct explanation from the teacher, and students are less encouraged to develop thinking skills, such as metacognitive skills and creative thinking (Yuangga, 2020).

Education as a human effort to develop self-potential through the learning process in order to achieve national education goals is still a common concern. Students were less encouraged to develop metacognitive skills, so this problem made students inactive and less participate in the learning process (Adita, 2016). In the 21st century, students are required to have learning and innovation skills, skills to use technology and information media, to be able to work, and to survive using life skills (Susilo, 2018). In the 21st century, schools are required to have creative thinking skills, critical thinking and problem solving, communication, and collaboration or what is commonly called 4C (Septikasari, 2018).

Based on the results of observations on September 28, 2021 at MA Miftahul Ulum Congkop Sampang, metacognitive skills and creative thinking were still not empowered properly to students. It was proven by the learning process still depends on the teacher using the lecture method and did not maximize the existing learning media, so that learning did not involve students to be actively involved. Students were less accustomed to writing or conveying learning reflections that are understood, not understood, and memorable. In addition, the results of observations on December 20, 2021 showed that learning activities still did not provide opportunities for students to express opinions based on their own understanding, because learning was still dominated by the teacher, students listened more to the explanations from the teacher. Until the end of learning, 100% students also have not been accustomed to creating a product or work as a result of their own creation.

Metacognitive skills are cognitive awareness or affective experiences that accompany intellectual effort or simply referred to as knowledge and awareness of cognitive abilities. This awareness includes monitoring of memory, comprehension, and cognitive effort. The lower the students' metacognitive skills, the lower the awareness of monitoring their cognitive abilities, which means that these students will not be able to develop their cognitive abilities (Aisyah, 2015). Metacognitive includes two components, namely metacognitive knowledge and metacognitive experiences. Metacognitive knowledge is knowledge that is used to direct thinking processes, while metacognitive experience refers to planning skills, monitoring skills, and evaluation skills. Planning skills, monitoring skills and evaluation skills are also called metacognitive skills that can help in solving problems. There are three essential skills that enable the regulation of the cognitive process, namely planning, monitoring, and evaluation. These three skills can enhance learning (Sugiarto, 2013).

Metacognitive skills help students to solve problems through effective design, involving the process of knowing the problem, understanding the problem, and understanding effective strategies to solve it. Metacognitive skills also help students in constructing the right concepts. The existence of various alternative frameworks encourages students to design, monitor, and assess concepts that are arranged to fit the correct concept (Muhali *et al.,* 2013).

In addition to metacognitive skills, creative thinking skills are also important to empower students. Creative thinking skills are new ways of seeing and doing things that contain four aspects, including: 1) fluency, seen from students building a new idea or the truth and fluency of the answers given by students, 2) flexibility, seen from the way of solving problems done by students, 3) originality, seen from the work that was actually made by students and not from modifications

of other people's work, 4) elaboration, it can be seen from the way students present the results of discussions in front of the class (Wulandari and Wardani 2019). Creative thinking skills are abilities that can produce or develop something new in other words something different from the ideas generated by most people. Creative thinking skills are also a form of thinking that leads to new maturity, new approaches, or new ways of understanding things (Ulandari *et al.*, 2019).

Creative thinking skills have an important role in life such as adding new knowledge and creating solutions to solve problems. Creative thinking has broad and unlimited benefits, so that it is able to find completely new things or renewable ideas/concepts. Someone who always thinks creatively will have a positive impact in planning and deciding an action and is more organized in action. Innovative plans as well as original products have been carefully thought out in advance taking into account the problems that may arise and their implications. So by thinking creatively, a plan can be executed properly and carefully from planning to implementation (Marliani, 2015).

Correlation is a term used to measure the strength between two variables. Correlation analysis is a way to find out whether or not there is a relationship between variables. The strength between variables can be seen from the results of the correlation coefficient values. The correlation coefficient is an index or number used to measure the closeness (strong, weak, or no relationship) between variables. Researchers often test or see whether there is a relationship between two or more variables, usually what is measured is students' skills in the learning process (Andini and Azizah, 2021).

Efforts to empower metacognitive skills and creative thinking skills in learning can be done by using certain learning models, namely learning models that can be used to empower these two skills. One model that can be applied is guided inquiry. Guided inquiry develops student learning activities optimally according to students' abilities. This learning model helps students in developing intellectual skills and other skills, such as asking questions and finding answers that start from their curiosity (Ulandari *et al.* 2019).

Regarding the relationship between metacognitive skills and creative thinking, previous research has explained that there is a relationship between metacognitive skills and students' creative thinking skills (Meko, 2021; Puente-díaz, Cavazos-arroyo, and Vargas-barrera, 2021; Jia, 2019)). The rest, research related to the relationship between the two variables has not been widely disclosed. The research on boarding schools based on Islamic boarding schools has also not been widely studied.

RESEARCH METHODS

Research Design

This study used a correlational design, which aimed to determine the single relationship between metacognitive skills and creative thinking skills of students. Measurement of metacognitive skills and creative thinking skills using a written test. The relationship between predictors and criteria can be seen in Figure 1.

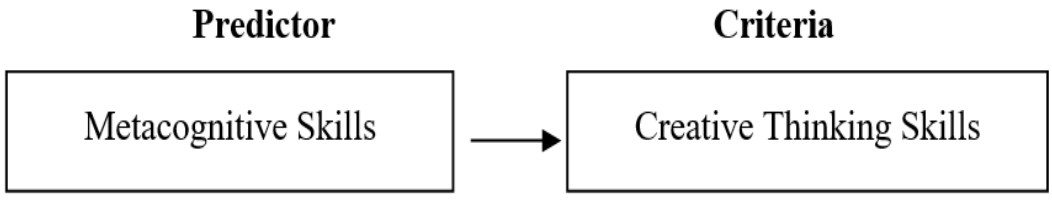

Figure 1. The relationship between metacognitive and creative thinking skills

Population and Samples

The population of this study were all 130 students of MA Miftahul Ulum Congkop Tlambah Karang Penang Sampang in the second semester, academic year 2021/2022. The sample used were class XI IPA A with 25 students that was carried out by random sampling.

Instruments

Metacognitive skills are measured by a rubric, namely a metacognitive skill rubric that is integrated with an essay test (Corebima, 2009). This rubric consists of 8 scales (0-7) consisting of the following components: 1) answers in their own sentences, 2) the order of exposure to coherent, systematic, and logical answers with correct grammar (language), 3) equipped with reasons (analysis/ evaluation/ creation), and 4) answers (true/less true/incorrect). The students' creative thinking skills were measured using the creativity assessment rubric (Munandar, 2013) that consists of fluency, flexibility, originality, and elaboration. The data obtained from the results of the study are student creativity score data. The rubric for assessing student creativity used in this study can be seen in Table 1.

Table 1. Creative thinking skills indicators

Aspects	Indicators
Fluence	Giving more than one correct answer and complete reasons.
Flexibility	Giving more than one answer that is diverse/different accompanied by complete reasons
Originality	Giving answers in their own way in accordance with the concept in question completely and accurately.
Elaboration	Describing solution to the given problem in detail and correctly.

Procedures

This research consisted of two stages, namely preparation and implementation. The first preparation were observation, research licensing, compiling learning tools (syllabus, lesson plans, worksheets, rubrics, and guided inquiry implementation sheets). The implementation stage was learning process according to lesson plan using guided inquiry, and posttest. After the data were obtained, data analysis was carried out, which included prerequisite and hypothesis test.

Data Analysis

The data obtained from the results of data collection were tested for prerequisites before testing the hypothesis. The prerequisite tests were normality test, linearity test, and homoscedasticity test. After the data was normally and linearly distributed, then the hypothesis was tested. The hypothesis test used was a regression correlation test using SPSS Version 26.0.

RESULTS

Description of Data

Data that has been obtained in this study included metacognitive and creative thinking skills. The average post test score data for metacognitive and creative thinking skills can be seen in Table 2.

Table 2. Descriptive statistics

	Mean	Std. Deviation	N
Creative	82.6250	5.48367	24
Metacognitive	59.1667	5.70786	24

Data Linearity Assumption Test

The test of linearity assumption was carried out to determine the linearity of data distribution between the variables X and Y. Figure 2 shows that the distribution of data or the relationship between X and Y is linear. Therefore, the assumption of linearity has been met and the model used is the linear regression equation Y= a + bX.

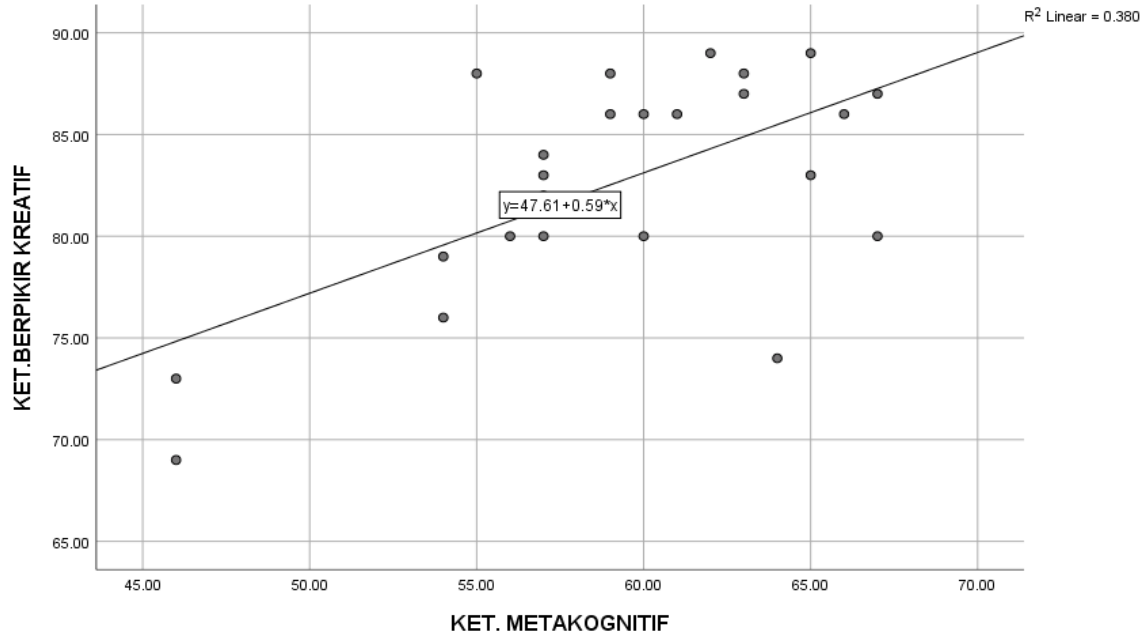

Figure 2. Linearity in data distribution

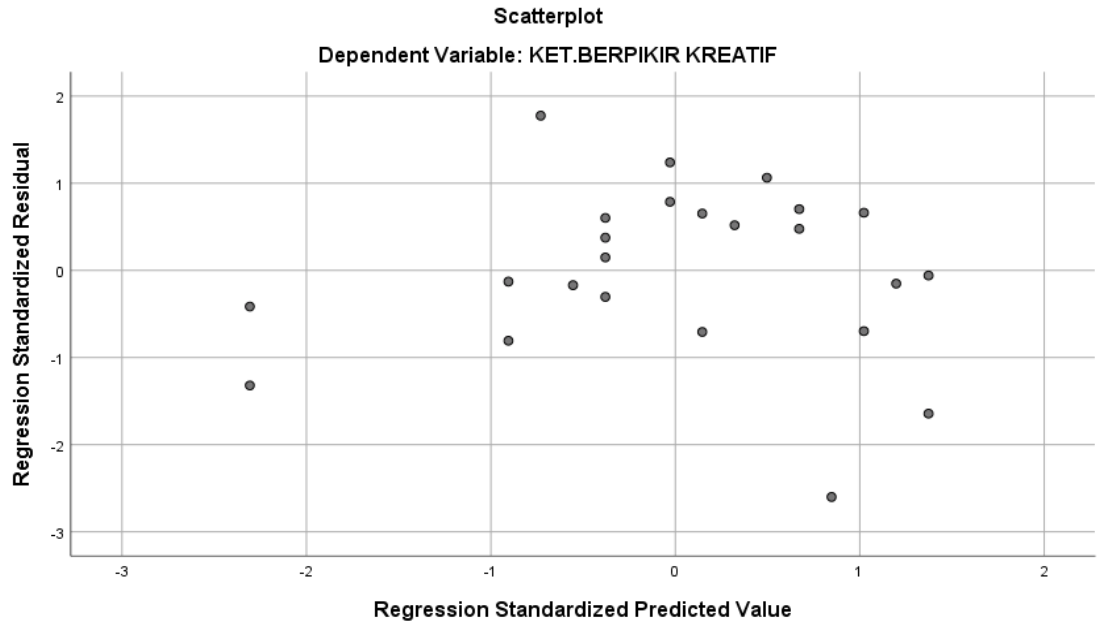

Figure 3. Homoscedasticity Graph

Residual Normality Assumption Test

Table 3 shows that the P value of 0.200 which means that the residuals are normally distributed, so that the assumption of normality of the residuals is met. Summary of the results of the normality assumption test for residual data can be seen in Table 3.

Table 3. The result of residual normality assumption

	Statistic	df	Sig.
Unstandardized Residual	.108	24	.200*

Homoscedasticity Assumption Test

The homoscedasticity assumption test aims to see or find out whether the variance of the residuals must be homogeneous or not. Homogeneous residuals are shown in the graph in Figure 2 with a random distribution of residues. These results indicate that the assumption of homoscedasticity is met.

Hypothesis Test

The results of hypothesis testing based on the results of data analysis regarding the magnitude of the correlation coefficient can be seen in Table 4.

Table 4. Summary of simple regression correlation test results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
I	.616[a]	.380	.351	4.41658	1.814

Table 4 shows that the magnitude of the simple correlation coefficient (R) is 0.616 with a reliability value (R^2) of 0.380. The R value of 0.616 indicates a strong relationship between metacognitive skills and creative thinking skills. In addition, R^2 value of 0.380 indicates that metacognitive skills contribute 38% to creative thinking skills, while the remaining 62% is influenced by other variables not examined or outside the scope of research. Table 5 of the correlation coefficient significance data of 0.001 ($p < 0.005$) shows that there is a significant relationship between metacognitive skills and creative thinking skills.

Table 5. Summary of correlation coefficient significance test analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
I	Regression	262.490	1	262.490	13.457	.001[b]
	Residual	429.135	22	19.506		
	Total	691.625	23			

Table 5 also shows that the sum of squares (SS) on the metacognitive skill variable is smaller than the residual SS. This indicates that the variable of metacognitive skills is slightly influenced by the variable of creative thinking skills, while the residuals describe other variables that are not explained by the researcher but contribute more to creative thinking skills. This happens because this research is social humanities research, where researchers need to be realistic that many of the phenomena studied are multifaceted, which means that there are many variables that are also correlated with the dependent variable. In other words, it is impossible for a phenomenon to be explained by only one dominant variable (Haikal, 2021).

Table 6. Model Coefficients – Creative Y

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
I	(Constant)	47.607	9.589		4.965	.000
	Metacognitive	.592	.161	.616	3.668	.001

Table 6 shows the equation of the regression line of the relationship between metacognitive skills and creative thinking skills in guided inquiry-based biology learning as follows.

$$Y = 47{,}607 + 0{,}592\ X$$

Based on the regression line equation above, it can be interpreted that the constant value of 47.607 means that the magnitude of the result of creative thinking skills will be worth 47.607 if the value of metacognitive skills is 0. The value of the B coefficient of 0.592 means that for every 1-point increase in metacognitive skills, creative thinking skills will increase by 0.592.

DISCUSSION

The results of hypothesis testing indicated that there was a positive relationship between metacognitive skills and creative thinking skills in biology learning for class XI students of MA Miftahul Ulum Nagasari Congkop Tlambah Karang Penang Sampang. The results of the regression analysis also showed a large R value of 0.616. The R value indicated that there was a strong relationship between metacognitive and creative thinking skills (Nurmasita *et al.* 2022). The results of this study also show a positive relationship, where the increase in metacognitive skills is followed by an increase in the value of creative thinking skills with the regression line equation obtained, namely Y = 47.607 + 0.592 X. The contribution of the predictor variable (metacognitive skills) to the criterion variable (creative thinking skills)) of 38%, while the remaining 62% was affected by other variables not examined.

The result of this study was relevant to previous research regarding the relationship between metacognitive skills and students' creative thinking skills which showed that there was a relationship between metacognitive skills and creative thinking skills (Jia, 2022). There are also other research results regarding the relationship between metacognitive skills and creative thinking skills which state that metacognitive skills and creative thinking skills are positively and significantly related (Rifqi, 2018; Sulistyawati, 2018; Kozikoglu, 2019; Puente-díaz, Cavazos-arroyo, and Vargas-barrera 2021; Harahap, Ahmad, and Situmorang 2021; Meko, 2021). The results are also strengthened by research which showed that the correlation coefficient between metacognitive skills and creative thinking skills is 0.718, which means the level of the relationship is in the strong category (Komaria and Wicaksono 2019; Gilang and Salam 2020).

Studies have reinforced the idea that creative problem solving is closely related to students' metacognitive skills (Kaufman *et al.* 2013; Hargrove and Nietfeld 2014). In fact, there is the term 'creative metacognition' as a special form of cognition that helps students to monitor and develop their creative competencies (Kaufman & Beghetto, 2013).. Therefore, metacognitive skills can be said to be a moderator of creative ideas and creative production (Puryear, 2016).

A person's metacognitive skills always develop with age and are influenced by routine exercises, when students' metacognitive abilities begin to develop, students' creative thinking levels will also increase (Tohir and Ibrahimy, 2019). The results of other studies which state that metacognition can improve creative thinking learning comprehensively (Fauzi, Dirgeyase, and Priyatno, 2019). Other research states that metacognitive skills are able to optimize the level of creative thinking in solving problems (Kartikasari, 2022).

Metacognitive strategy is a strategy in solving problems, namely consciously linking new information and old information, choosing appropriate strategies, planning and monitoring the thinking process (Sunanto and Asyiah, 2018). Metacognitive strategies refer to ways to increase awareness of thinking and learning processes, so that when this awareness is realized, metacognitive skills will arise (Siregar, 2019). Metacognition skills possessed by students enable them to develop comprehension of concepts because students can construct knowledge, apply, and deepen concepts, so that they can provide scientific answers that represent their comprehension (Hermanto and

Pratiwi, 2021). Metacognition emphasizes the individual's awareness of his own thought process or of the individual's thinking processes and procedures as thinkers and actors so that they are aware of controlling and monitoring mental activities or mental processes (Putri, Dirgantoro, and Harapan, 2018).

Metacognitive skills have the aim of growing students' awareness in designing, monitoring, and controlling what is known, what is needed to do, and how to do it in solving problems through questions in the metacognitive process (Refianti, 2022). In the learning process, metacognition becomes important for students to realize what they should do when they make mistakes and evaluate their work, not only that students are expected to be able to assess which strategies are effective to use and which are not efektif (Lestari, Selvia, and Layliyyah 2019). Metacognitive skills in learning have many benefits, including increasing activity, creativity, and increasing students' enthusiasm for learning, so that students' abilities will increase (Ismiyah and Nindiasari, 2020). High metacognitive skills can help students think creatively in solving problems (Suryaningtyas and Setyaningrum, 2020).

In addition to metacognitive skills, creative thinking skills also have a very important role in improving students' understanding and creativity in learning and can help in solving problems and finding alternative problem solving (A.F. Suryaning Ati MZI and Suryanti, 2021). Creative thinking is the stage of thinking by adjusting a good and correct answer to help students see a problem from various perspectives, and be able to provide many ideas or solutions in solving problems (Wulandari and Wardani, 2019). Creative thinking is a mental activity in generating ideas, solving problems, or finding certain patterns that are interrelated in finding meaning (Jagom et al. 2021).

Empowerment of metacognitive and creative thinking skills has been carried out explicitly at higher education levels to stimulate the creative potential of future professionals (Saputra and Retno Andriyani, 2018). Metacognitive skills and creative thinking skills are skills that need to be empowered in the 21st century. One of the learning models that can empower metacognitive skills and creative thinking skills is inquiry (Astriani *et al,* 2020), and this research used guided inquiry. The guided inquiry learning model is a learning method that requires students to find, collect data, and use various information and ideas under the supervision of the teacher, so that students find their own concepts (Murnaka and Dewi, 2018).

Previous studies reported that guided inquiry was very effective in empowering students' metacognitive and creative thinking skills (Divrik, Pilten, and Mentiş, 2020). There is also another study which stated that inquiry learning was very good in empowering students' metacognitive and creative thinking skills in biology (Destrilia, Hasan, and Rifa'i, 2021). This is supported by research stated that the guided inquiry learning model can help to improve students' metacognitive skills and creativity (Salam, 2020; Nyoman *et al.* 2021; Fadillah, 2022).

The results showed that there was a strong relationship between metacognitive skills and students' creative thinking skills. The results of this study also explained that these two variables were very important to be empowered in learning. In addition, guided inquiry is a recommended learning model, especially biology learning.

CONCLUSION

Based on the results of the study, there is a positive relationship between metacognitive skills and creative thinking skills of class XI MA Mifahul Ulum Nagasari Congkop Tlambah Karang Penang Sampang students. Correlation coefficient (R) is 0.616 with a reliability value (R^2) of 0.380. The R value of 0.616 indicates a strong relationship between metacognitive skills and creative thinking skills. In addition, R^2 value of 0.380 indicates that metacognitive skills contribute 38% to creative thinking skills. This research was conducted in a boarding school, where students

have a tendency to place more importance on religious material than general learning such as biology. With guided inquiry, students were enthusiastic in learning, so that metacognitive empowerment and students' creative thinking skills can be carried out optimally.

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