OPEN ACCESS
Jurnal Riset Pendidikan MIPA, 9(2): 95-102, December 2025
ISSN 2549-0192 (e) | 2549-0184 (p)
http://new.jurnal.untad.ac.id/index.php/jrpm/

The Effect of Thinking Style and Metacognitive Awareness on Ability Student Cognitive About Biology in Integrated Islamic SMA

***Fahmi, Andi Tanra Tellu, & Mohammad Jamhari**
Pendidikan Sains Program Magister/Pascasarjana – Universitas Tadulako, Palu – Indonesia 94118
Email corresponding author: fahmiidris294@gmail.com

Article History
Received 26 August 2025
Revised 30 October 2025
Accepted 27 November 2025

Keywords:
Thinking Style,
Metacognitive Awareness,
Cognitive Ability

Abstract

This study aims to analyze the effect of thinking style and metacognitive awareness on students' cognitive abilities. This research is an Ex-post-facto research. The population consists of all students of SMA Islam Terpadu for the academic year 2021-2022. Determination of the sample using a saturated sampling technique. The thinking style and metacognitive awareness instrument uses a thinking style questionnaire and metacognitive awareness inventory. The data were then analyzed using multiple linear regression with the help of SPSS 21. The results showed that partially the thinking style had no significant effect on cognitive abilities, while metacognitive awareness had a significant effect, but simultaneously had a significant effect.

doi: 10.22487/j25490192.2025.v9.i2.pp 95-102

Introduction

The quality of education in Indonesia currently still requires improvements and support in order to be able to compete in the globalization era. Education is closely related to the learning process, the ideal learning process is to help students master a number of competencies effectively and efficiently. Measuring the success of the learning process and the achievement of competencies can be through evaluating cognitive abilities which are part of learning outcomes.

Cognitive ability is a complex thinking process experienced by a person related to object representation, the representation process includes problem solving, rationale, remembering, and use (Shopia & Rochana, 2020; Zakiah & Khairi, 2019). This cognitive ability is related to what a person does to understand something through a complex process to become knowledge, in this case related to learning process activities that cannot be separated from remembering and thinking, furthermore related to learning outcomes or achievements.

Yulianti (2015) explains that learning outcomes are information regarding the achievement of expected competencies after students participate in learning activities. This information is obtained through a series of evaluation activities to measure and assess student learning outcomes. Currently, the achievement of student learning outcomes in Indonesia has not experienced a significant increase from year to year, even though the government has implemented various policies. This is supported by data from the Program for International Student Assessment (PISA) survey, that the achievement of Indonesian children in science ranks 71st out of 79 countries (OECD, 2018). Based on data at the Integrated Islamic High School (IT) Sigi for the 2019-2020 Academic Year in the Odd Semester, as many as 54% of students did not meet the minimum completeness criteria (KKM) and in the even semester as many as 64% of students did not meet the KKM. According to Trianto (2011), classical completeness is achieved if <15% of all students do not reach the KKM, if this criterion is not achieved it means that the learning process is still not optimal.

This can be caused by learning that is not interesting, so students become passive. Based on initial observations, students' interest in studying biology was still low, marked by the lack of activities to take notes, ask questions, and do assignments. Passive learning activities are influenced by learning that is not in accordance with the characteristics of students.

One of the internal factors that influence, namely thinking style, is a way of organizing and managing the information obtained or a combination of how a person receives and processes the information he gets in the brain (Deporter & Hernacki, 2015; Firdaus, Nisa, & Nadhifah, 2019). Thinking style is a person's way of using the abilities that exist within him in certain ways. Thinking style is the tendency of someone who is relatively the same in organizing and processing information (Uno, 2006). Students' thinking styles are influenced by habits that are carried out in everyday life, so that each student has a way of developing his thinking skills in different ways (Sanusi, Arafah, & Amin, 2020). Different styles of thinking cause students to have differences in receiving and processing information effectively in different ways, the implications for students'

understanding abilities are not the same, further affecting learning outcomes. The results of Basyirun & Oktavia's research (2017) show that there is a positive and significant influence of thinking styles on social studies learning outcomes for Class VIII students. Furthermore, according to the results of research by Depary & Mukhtar (2013), students with a concrete sequential thinking style get better learning outcomes. better than students who have an abstract sequential thinking style.

Setyawan & Rahman (2013), explain the level of understanding of each student is different due to differences in thinking styles. This is evidenced by giving the same questions, but students work in different ways, but with the same answers. The problem experienced by some students is the difficulty of changing concrete things into abstract things, or vice versa. This is seen as a result of the different thinking styles possessed by students (Ananda, Fauzi, & Yamin, 2018). Besides that, thinking style is also related to students' ability to think creatively in solving problems (Bancong, 2014). Thinking styles are important as consideration for educators in designing approaches, strategies, and methods so that a learning atmosphere is formed that is able to encourage optimal cognitive abilities. Another factor that influences cognitive abilities is metacognitive awareness.

Metacognitive is the ability to integrate cognitive knowledge and cognitive regulation (Hermawan, Abidin, & Junaedi, 2018). Metacognitive, namely the ability to think about the learning process, be aware of the factors that influence intellectual performance, know how, when, where, and why to use certain strategies, this ability is used to help and adjust student learning performance (Wilson & Conyers, 2016). Metacognitive knowledge is knowledge of one's own strengths and weaknesses, and uses it in studying technical, detailed, specific, complex, contextual, and conditional knowledge with respect to science, technology, art, and culture related to society (Kementerian Pendidikan dan Kebudayaan Republik Indonesia, 2016).

Metacognitive is the ability to reflect on what someone knows and does and what someone doesn't know and doesn't do (Rinaldi, 2017). Metacognitive becomes important because it is an influential part of the individual learning process. Students who have metacognitive awareness are able to know how to think and control their learning according to their own circumstances (Wardana, Prihatini, & Hidaya, 2021). Research conducted by Masrura & Murtafiah (2018), shows that the higher the students' metacognitive awareness, the higher their academic achievement.

Students who have metacognitive awareness will have an advantage in the learning process. This is due to his ability to know the strengths and weaknesses in learning, and being able to make improvements in learning by choosing the best and most effective way of learning. Students who are aware of their metacognitive abilities are more strategic and perform better than students who are not aware because they know things related to cognitive knowledge and cognitive regulation (Schraw & Dennison, 1994).

Both of these factors are thought to have a relationship in influencing student learning processes, further influencing learning outcomes, in this case cognitive ability as a product of thinking processes carried out by students. The results of interviews with IT high school biology teachers revealed that research on thinking styles and metacognitive awareness had never been conducted at that school, so teachers did not know the characteristics of their students.

Low understanding of student characteristics contributes greatly to the decline in the quality of learning. Learning will be more effective if it is designed and developed based on students' conditions (Munahefi, et al., 2020), thus it is necessary to know and understand how the factors that have the potential to influence student abilities are related. The availability of this data will enable the preparation and improvement of the learning process in accordance with the conditions of the students, so that the learning process takes place effectively and the results are in line with expectations. Obtaining this data certainly has to go through a study, prospective researchers are interested in uncovering the influence between thinking styles and metacognitive awareness on students' cognitive abilities.

Previous studies have focused on the influence of thinking styles and metacognitive awareness partially on learning outcomes in general. This study will focus on the objective of knowing the effect of thinking styles and metacognitive awareness partially and simultaneously on one aspect of learning outcomes, namely students' cognitive abilities.

Materials and Method

The scientific method is a method used to obtain data with specific purposes and uses based on scientific processes (Sugiyono, 2016). In this study the type used is ex-post-facto, which is research conducted after an incident has occurred. Research like this aims to find causes that allow changes in behavior, symptoms or phenomena caused by an event. Behavior or things that cause changes in the independent variables as a whole have happened. Ex-post-facto research methodologically also tests hypotheses but does not provide certain treatments for reasons that are less ethical to provide treatment or provide manipulation. These reasons are related to human ethics, or these symptoms/events have occurred and want to explore the causative factors or the things that influence them (Widarto, 2013).

The population in this study were all Islamic high school students for the 2021/2022 academic year, which consisted of 3 classes with a total of 124 students. The sample used was all students of the

Integrated Islamic High School for the 2021/2022 academic year (saturated sampling) with a total of 49 male students and 75 female students. The sample is determined by saturated sampling technique, that is, all members of the population are sampled. The data collection technique used is first with a questionnaire technique using a closed questionnaire, for thinking style data using a thinking style questionnaire consisting of 15 items, students are required to choose 2 words for each item by giving it only once at the beginning of the meeting, while metacognitive awareness students used the metacognitive awareness inventory (MAI) instrument which consisted of 8 indicators namely declarative knowledge, procedural knowledge, conditional knowledge, planning, information management strategy, understanding monitoring, debugging strategy, and learning evaluation with a total of 52 statement items. There are 4 alternative choices, namely very suitable (SS), appropriate (S), not suitable (TS), and very inappropriate (STS). with a total of 52 items with 4 choices on each item, students then choose by ticking the options that really suit their conditions. The second is a test technique to measure students' cognitive abilities, while the instrument used is a matter of 30 items that have been tested for validity, reliability, discriminating power, and level of difficulty. The data obtained was tested with classical assumptions, namely normality, linearity, multicollinearity, and heteroscedasticity tests. Then proceed with hypothesis testing using multiple linear regression, the test is carried out with the help of SPPS 21.

Results and Discussion

Validity test

The validity test was carried out using the product moment correlation method with the criteria if sig <0.05 then the instrument or item was declared valid, from measuring the validity of the instrument it was found that in class X there were 39 valid items, class XI 34 items, and class XII 36 items.

Reliability test

The reliable test technique used is Spearman-Brown and the reliability obtained in class X, XI, and XII is 0.97 which is included in the very high reliable category.

Difficulty level

Testing the level of difficulty in class X obtained 30 items that passed the test, in class XI 31 items passed the test, and in class XII obtained 34 items passed the test.

Discriminating power

In the differentiation test, it was found that in class X there were 42 items that passed the discriminating power test, in class XI there were 38 items that passed the discriminating power test and in class XII there were 37 items that passed the discriminating power test.

Prerequisite Test

Normality test

In the test, a sig of 0.325 is obtained, the value shows greater than 0.05, which means that the data is normally distributed.

linearity test

The test shows that between X1 and Y sig is 0.396 which is greater than 0.05 which means there is no linearity, while at X2 and Y sig is 0.00 which is less than 0.05 which means linear and the deviation from linearity sig is 0.070 greater of 0.05 which means that there is no pattern formed from errors in the model.

Multicollinearity test

In this test the tolerance value of 0.957 is greater than 0.10 and the VIF value of 1.045 is less than 10, which means that there is no multicollinearity.

Heteroscedasticity test

In the test, the sig value was 0.112 and 0.064, which was greater than 0.05, which meant that there was no heteroscedasticity.

The effect of thinking styles on cognitive abilities

The significance obtained is 0.054 > 0.05 so that H0 is accepted which means that there is no significant effect of thinking style on students' cognitive abilities.

Table 1. Distribution of Thinking Styles

Thinking Style	Amount	Percentage (%)
Concrete Sequential	28	22,6
Abstract Sequential	30	24,2
Concrete Random	27	21,8
Abstract Random	39	31,5

Based on Table 1, it can be explained that the highest distribution of thinking styles is in abstract random thinking style, namely 39 students, while concrete sequential, abstract sequential, and concrete random are relatively the same.

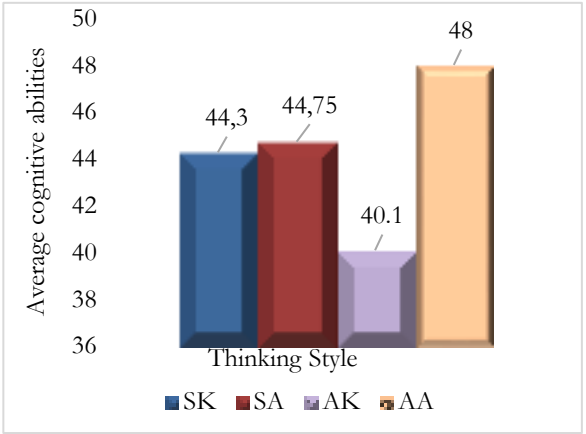


Figure 1. Average Cognitive Ability Based on Thinking Style

Based on Figure 1, it can be explained that the highest students' cognitive ability is in abstract random thinking style, namely 48 and the lowest is in concrete random, namely 40.1. Regression test shows sig 0.054 > 0.05 which means that thinking style has no significant effect on students' cognitive abilities.

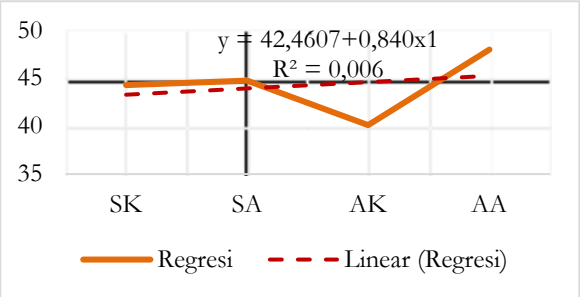


Figure 2. Regression of the Effect of Thinking Style on Cognitive Ability

Figure 2. shows that the effect of thinking style on cognitive ability is not linear, that is, a straight line does not form between thinking style and cognitive ability. The regression equation is y = 42.4607 + 0.840x1 and the coefficient of determination R2 = 0.006, which means that cognitive ability is influenced by thinking style by 0.6%.

The results of this study showed that the largest distribution of thinking styles was in abstract random, namely 39 students, random sequential 30 students, concrete sequential 28 students, and concrete random 27 students. Based on these data it can be explained that the distribution of random sequential, concrete sequential, and concrete random thinking styles is relatively the same. The hypothesis test shows that thinking style has no significant effect on students' cognitive abilities (Figure 1). This is consistent with the results of the regression equation which shows that a linear line is not formed between thinking style and cognitive ability, which means that the resulting regression equation cannot be used to predict or infer the value of variable Y.

These results are inconsistent with research conducted by Yusnidah (2020), which explains that students who have an abstract sequential thinking style tend to have better learning outcomes. This causes students to have logical, rational, and intellectual thinking processes. Abstract sequential type thinkers tend to read and research in depth, when doing and thinking about something to find out the causes behind the effects and understand the theory and concepts, so it will be easier to find things or important details in a problem.

The characteristic of the abstract sequential thinking style is understanding the problem by writing down the answers in their own sentences in full and the order and meaning are the same as the question descriptions. Solve it in two ways, if the first method has problems then don't proceed and choose another way to solve the problem you have, when carrying out the plan students write down the completion steps in sequence and write them down in detail.

In theory, the style of thinking has the potential to influence students' cognitive abilities. Thinking style is a person's tendency to organize and process information obtained from learning, so that it becomes knowledge which is then used to solve or respond to a problem.

Thinking styles do not always show significant differences between these thinking styles, due to the use of learning models that also influence the magnitude of the influence of thinking styles on cognitive abilities. Learning models or strategies that focus on the use of abstract material, concepts, gathering information by reading, and solving problems systematically based on theories, students with an abstract sequential thinking style will enjoy participating in learning and show better cognitive abilities. If the learning or strategy used is oriented towards teacher instruction and direction by looking at reality through the physical senses, namely the senses of sight, touch, hearing, taste, and smell, then students with a concrete sequential thinking style will mobilize their potential to understand the material, so that their ability better cognitive.

Based on observations, biology teachers at Sigi Integrated Islamic High School use different learning models, namely the PBL (problem based learning) model by presenting problems that occur in the surrounding environment, the conventional model with the lecture method and emphasizing on reading material that has been given by the teacher. interspersed with exercises.

The learning model or strategy is able to accommodate the characteristics of each thinking style, so the cognitive ability will be relatively the same or not significantly different. This supports the statement of Depary & Mukhtar (2013), that the physics learning outcomes of students with a concrete sequential thinking style will be higher if they use the PAKEM learning model, while the abstract sequential thinking style will have better learning outcomes if they use the expository model.

The different characteristics of thinking styles make an educator must be able to use learning models or strategies that are appropriate to the thinking style. Each thinking style has its own advantages and disadvantages, as stated by Dryden & Jeanette (2000), that there is no superior thinking style, each thinking style is unique and effective in its own way.

Another factor that supports the rejection of the alternative hypothesis is that students' awareness of their own thinking style is still low, so they are not able to optimize the steps that must be taken to carry out the learning process in accordance with the characteristics of their thinking style. Other internal conditions of students such as the amount of motivation and prior knowledge of students also have an effect. This is in line with what

was explained by Dwirahayu & Firdausi (2016), that thinking style has no significant effect because thinking style is a tendency that exists in oneself which does not hinder the learning environment. The relation with this research is that students have different initial knowledge that they obtained at the previous level of education. In addition, the motivation to achieve and compete to get the best grades encourages students to actively increase positive behavior in learning that supports no significant effect of thinking styles on students' cognitive abilities.

The results of this study indicate that thinking style has no significant effect on cognitive abilities. However, it appears that the highest average cognitive abilities of students are sequentially owned by abstract random thinking (AK), abstract sequential (SA), concrete sequential (SK), and concrete random (AK). This means that abstract thinking styles both sequential and random have a higher average cognitive ability. These results support the opinion of Piaget (1964), that children aged 11 years and over use concrete things to form more complex operations. At this stage students have entered the formal operational stage, namely being able to think without the aid of concrete objects or events, students are able to think abstractly, logically, and more idealistically. Students are able to accept assumptions without requiring physical evidence to validate these assumptions, develop hypotheses and test them, are able to idealize, and imagine possibilities (Samaiya, 2022).

The effect of metacognitive awareness on cognitive abilities

The significance obtained is 0.000 <0.05 so that H1 is accepted which means that there is a significant influence of thinking style on students' cognitive abilities

Metacognitive Awareness	Amount	Percentage (%)
Very high	84	67,7
high	40	32,3
moderate	0	0
Low	0	0
Very low	0	0

Table 2. Distribution of Metacognitive Awareness

Based on Table 2, it can be explained that the highest distribution of metacognitive awareness was in the very high category, namely
84 students, in the high category, namely 40 students, while in the moderate, low, and very low categories, namely 0 students.

Figure 3. Average Cognitive Ability of Students Based on Metacognitive Awareness

Based on Figure 3, metacognitive awareness in the very low, low and sufficient categories has an average cognitive ability of 0, while in the high category it is 74 and in the very high category it is 84. The regression test shows sig 0.00 <0.05, which means that metacognitive awareness has a significant effect on students' cognitive abilities.

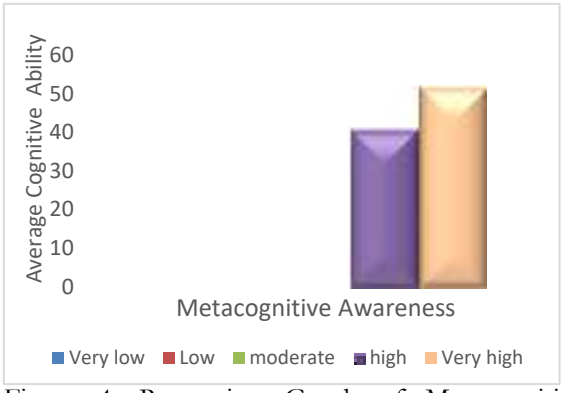


Figure 4. Regression Graph of Metacognitive Awareness on Cognitive Ability

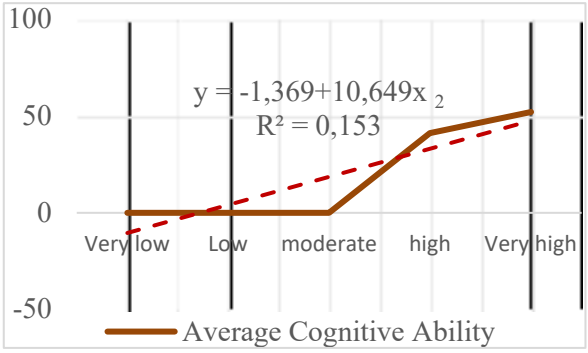


Figure 4. shows metacognitive awareness of linear cognitive abilities, namely a straight line is formed between metacognitive awareness and cognitive abilities. The regression equation is y = – 1.369 + 10.649x2 and the coefficient of determination R2 = 0.153, which means that cognitive abilities are influenced by metacognitive awareness of 15.3%.

Cognitive abilities are also viewed from metacognitive awareness, descriptively showing that the majority of students have metacognitive awareness in the very high category, namely 84 students and the rest are in the high category, namely 40 students. Based on inferential analysis, it shows sig 0.00 <0.05 which means that there is a significant effect of metacognitive awareness on students' cognitive abilities (Figure 3). This is consistent with the regression equation which shows the formation of a linear line and a positive effect, which means that the regression equation can be used to predict or infer the value of cognitive ability as the dependent variable.

The results of this study are in line with research conducted by Riyanti, Ngadiman & Hamidi (2019), that there is a positive and significant influence of metacognitive awareness on learning outcomes, especially the cognitive domain. Likewise, what was done by Sonyinga, Danial, & Herawati (2019), that there are differences in the learning outcomes of students who have high metacognitive awareness compared to low metacognitive awareness. This can happen because of metacognitive awareness which is one of the

internal factors that allows students to be aware and know about their metacognitive abilities. This is in line with the opinion of Hermawan, Abidin, & Junaedi (2018), if metacognitive awareness is realized then one can start thinking by designing, monitoring, and assessing what is learned.

The results of this study also show the linearity of metacognitive awareness with cognitive ability, which means that the higher the metacognitive awareness, the higher the cognitive ability. This means that metacognitive awareness is important in the learning process, especially controlling cognitive activity, as Ormrod (2009) argues, that the more students know about their metacognitive awareness, the better the learning process and achievements they might achieve.

The higher the metacognitive awareness, the more capable the students are in planning learning strategies and evaluating the results of learning. In simple terms, students will be able to know what to do and what not to do, be able to become independent learners who know strengths, weaknesses, and how to overcome them to improve a good learning process so that it has implications for cognitive abilities. Students with high metacognitive awareness solve problems by understanding problems, designing problem solving, applying problem solving models and then assessing the results, in contrast to students who have low metacognitive awareness who are unable to control the learning process effectively.

However, when viewed from the magnitude of the influence of metacognitive awareness on cognitive abilities, it is equal to 15.3%. These results are contrary to research conducted by Helendra & Fauzan (2015), with the results of the contribution of metacognitive awareness to learning outcomes of 74.99%. This can be caused by the lack of the teacher's role in training to utilize students' metacognitive awareness in increasing student learning achievement to the maximum (Nurdin, 2007). So it is important to train and empower students' metacognitive awareness by teaching them to choose, use, and control their cognitive strategies in learning to understand material and solve problems. As Livingstone (2003) argues, empowering students' metacognitive awareness in learning will affect cognitive learning outcomes.

The results of this study support previous research, namely showing that the percentage contribution of metacognitive awareness to learning outcomes is less than 50% but positive (Fitria, Jamaluddin., & Artasaya, 2020; Anindya,, Mahrus, & Hadiprayitno, 2019; Andriyani, 2015). This can be due to the underdeveloped ability of self-management, namely the ability to control activities related to learning such as planning, using strategies, and evaluating the learning process. Besides that, the implementation of the learning process that does not stimulate students to understand problems and find solutions makes students' self-management abilities not develop and has an impact on low metacognitive awareness, so that it also has an impact on cognitive abilities. As stated by Mustami (2015), that metacognitive activity occurs when students consciously adjust and manage their thinking strategies when solving problems and thinking about goals.

The effect of thinking style and metacognitive awareness on cognitive abilities

Based on multiple linear analysis, a sig of 0.00 <0.05 was obtained, which means that thinking style and metacognitive awareness simultaneously have a significant effect on students' cognitive abilities. The regression equation is Y = -10.167 + 1.822x1 + 11.579x2. The regression equation model can be used to predict and draw conclusions regarding the effect of thinking styles and metacognitive awareness on cognitive abilities. The coefficient of determination R2 is 0.179, which means that cognitive ability is influenced by thinking style and metacognitive awareness of 17.9%.

Simultaneously, the significance of linear regression was obtained sig 0.00 <0.05, which means that there is a significant influence of thinking style and metacognitive awareness on students' cognitive abilities. The regression equation is Y = -10.167 + 1.822x1 + 11.579x2 with a coefficient of determination of 17.9%.

These results are in line with those carried out by Tamsyani (2016), that the influence of learning models and metacognitive awareness simultaneously affects improving learning outcomes in acid-base material. Likewise research conducted by Riyanti (2019), that metacognitive awareness and motivation jointly have an influence on learning outcomes, which means that factors that affect cognitive abilities can affect partially or simultaneously.

The results of multiple linear regression tests show that there is an interaction between thinking style and metacognitive awareness which has a positive influence. This is due to the style of thinking which is a habit that is relatively used in processing and organizing information so that one can use one's abilities (Uno, 2006; Gregorc, 1982). So that cognitive abilities which are the result of the mind's work processes will be related to cognitive abilities. In addition, metacognitive awareness also has an important role in preparing students to become self-learners, in relation to thinking styles, that is, if students have high metacognitive awareness, students are able to identify the factors that make a learning process more effective for themselves. If the student's thinking style is appropriate and there is an increase in metacognitive awareness, there will also be an increase in cognitive ability.

Students who have metacognitive awareness will be aware of their own thinking processes or thinking styles, especially in the regulation of cognition which consists of a planning component. In this component students will be able to determine goals and manage the use of teaching

materials for learning in accordance with their thinking style. The thinking style with concrete perception (concrete sequential and concrete random) will choose teaching materials that use lots of concrete examples, while abstract perception (abstract sequential and abstract random) will choose teaching materials related to theory, conceptual, and abstract.

The second component is information management strategies, the sequence of skills or strategies used to process information efficiently. Students who know their thinking style will apply learning strategies that suit their thinking style. The style of thinking with sequential regulation (concrete sequential and abstract sequential) will choose to do something in a step-by-step process and try to get perfection, learn through structured activities, do assignments on time. While the style of thinking with random regulation will choose to do things in its own way (does not like direction), the way of learning is disorganized, feeling limited when placed in a very structured environment. The third component is monitoring understanding (comprehension monitoring), in this component students will conduct an assessment of the learning strategy that is being used.

Understanding of these components allows students to be able to know how to learn (learning how to learn) by preparing the best learning strategies to learn according to the characteristics of the thinking style they have. The learning process will become more effective and improve students' cognitive abilities, so the role of the educator is also important to carry out the learning process according to student characteristics including thinking styles and metacognitive awareness. This is in line with what was explained by Munahefi, et al., (2020), that the low understanding of student characteristics contributes greatly to a decrease in the quality of learning, because learning will be more effective if it is designed and developed according to student conditions.

Conclusion

Based on the research that has been done, it can be concluded several things as follows: Thinking style has no significant effect on students' cognitive abilities, Metacognitive awareness has a significant effect on cognitive ability, so that the higher the metacognitive awareness, the higher the cognitive ability, and Thinking style and metacognitive awareness simultaneously have a significant effect on students' cognitive abilities

Acknowledgements

The authors would like to thank the Director of the Postgraduate Program for facilitating this research.

References

Ananda, N., Fauzi, F., & Yamin, M. Y. M. (2018). Gaya berpikir siswa dalam menyelesaikan soal matematika kelas IV di MIN Peukan Bada Kabupaten Aceh Besar. *Jurnal Ilmiah Mahasiswa Pendidikan Guru Sekolah Dasar, 3*(1), 1–7.

Anindya, I. A. W., Mahrus, M., & Hadiprayitno, G. (2019). Hubungan kesadaran metakognisi siswa dengan hasil belajar IPA melalui penerapan model pembelajaran berbasis masalah di SMP Negeri 2 Kuripan. *Jurnal Pendidikan Biologi, 10*(2), 66–73.

Andriyani, H. (2015). *Hubungan antara kesadaran metakognisi dengan hasil belajar mahasiswa baru Jurusan Pendidikan MIPA FKIP Universitas Mataram* (Skripsi sarjana, Universitas Mataram). Repositori Universitas Mataram.

Bancong, H. (2014). Studi kualitatif gaya berpikir peserta didik dalam memecahkan masalah fisika. *Berkala Fisika Indonesia, 6*(1), 1–7.

Basyirun, F., & Oktavia, N. (2017). Pengaruh gaya berpikir siswa terhadap hasil belajar IPS siswa kelas VIII SMP Negeri 3 Kota Solok. *Jurnal Sosial dan Ilmu Ekonomi, 2*(1), 26–31.

Depary, S., & Mukhtar. (2013). Model pembelajaran dan gaya berpikir terhadap hasil belajar fisika. *Jurnal Teknologi Pendidikan, 6*(1), 93–107.

DePorter, B., & Hernacki, M. (2015). *Quantum learning: Membiasakan belajar nyaman dan menyenangkan*. Bandung: Kaifa.

Dryden, G., & Vos, J. (2000). *Revolusi cara belajar (The Learning Revolution): Belajar akan efektif kalau Anda dalam keadaan "fun"*. Kaifa.

Dwirahayu, G., & Firdausi. (2016). Pengaruh gaya berpikir terhadap kemampuan koneksi matematis mahasiswa. *Jurnal Penelitian dan Pembelajaran Matematika, 9*(2), 210–221.

Firdaus, A., Nisa, L. C., & Nadhifah. (2019). Kemampuan berpikir kritis siswa pada materi barisan dan deret berdasarkan gaya berpikir. *Kreano: Jurnal Matematika Kreatif-Inovatif, 10*(1), 68–77.

Fitria, L., Jamaluddin, & Artayasa, I. P. (2020). Analisis hubungan antara kesadaran metakognitif dengan hasil belajar matematika dan IPA siswa SMA di Kota Mataram. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran, 6*(1), 147–155.

Gregorc, A. F. (1982). *An adult's guide to style*. Gabriel Systems.

Helendra., R. D., & Fauzan.(2015). Kemampuan Metakognisi Siswa Kelas XI IPA SMA Negeri 3 Padang dan Hubungannya dengan Kompetensi Belajar Biologi. *Prosiding Semirata*, 4(1), 190-199.

Hermawan, W., Abidin, Z., & Junaedi, E. (2018). Peran gender dan kesadaran metakognitif siswa SMA di Kabupaten Kuningan

Terhadap hasil belajar biologi. *Jurnal Pendidikan dan Biologi*, 10(2), 11-18.

Livingston, J. A. (2003). *Metacognition: An overview*. State University of New York at Buffalo.

Masrura., & Murtafiah, W. (2018). Kontribusi kesadaran metakognisi dan motivasi belajar matematika terhadap prestasi akademik mahasiswa FMIPA Universitas Sulawesi Barat. *Jurnal Saintifik, 4*(1), 74–82.

Munahefia, D. N., Kartono, Waluya, B., & Dwijanto. (2020). Kemampuan berpikir kreatif matematis pada tiap gaya berpikir Gregorc. *PRISMA: Prosiding Seminar Nasional Matematika, 3*, 650–659.

Mustami, M. K. (2015). *Metodologi penelitian pendidikan*. Yogyakarta: Aynat Publishing

Nurdin. (2007). Model pembelajaran matematika yang menumbuhkan kemampuan metakognitif untuk menguasai bahan ajar. *Disertasi*. Universitas Negeri Surabaya.

OECD. (2019). *PISA 2018 results (Volume I): What students know and can do*. OECD Publishing

Ormrod, J. E. (2009). *Psikologi pendidikan: Membantu siswa tumbuh dan berkembang* (Jilid 1, Edisi ke-6). Jakarta: Erlangga.

Kementerian Pendidikan dan Kebudayaan Republik Indonesia. (2016). *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 20 Tahun 2016 tentang Standar Kompetensi Lulusan Pendidikan Dasar dan Menengah*.

Piaget, J. (1964). Development and learning. *Journal of Research in Science Teaching, 2*(3), 176–186.

Rinaldi. (2017). Kesadaran metakognitif. *Jurnal Riset Aktual Psikologi*, 8(1), 79-87.

Riyanti, A. I., Ngadiman, & Hamidi, N. (2019). Pengaruh kesadaran metakognisi dan motivasi belajar terhadap hasil belajar siswa. *Tata Arta: Jurnal Pendidikan Akuntansi, 5*(1), 17–31.

Samaiya, A. (2022). Jean Piaget's cognitive development. *International Journal of Indian Psychology, 10*(1), 1510–1513.

Sanusi, D. K., Arafah, K., & Amin, B. B. (2020). Analisis gaya berpikir sekuensial-acak abstrak dalam memecahkan masalah fisika. *Jurnal Pendidikan Fisika Tadulako*, 8(1), 60-66.

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19*(4), 460–475.

Setyawan, D & A. Rahman. (2013). Eksplorasi proses konstruksi pengetahuan matematika berdasarkan gaya berpikir. *Jurnal Sainsmat*, 2(2), 140-152.

Shopia, N & S. Rochana. (2020). Analisis pengaruh kemampuan kognitif mahasiswa terhadap kemampuan representasi matematis pada materi assignment problem. *Prosisding Semnar Nasional Penalaran dan Penelitian Nusantara*, 1, 21-34.

Sonyinga, D., Danial, M., & Herawati, N. (2019). Pengaruh model pembelajaran dan kesadaran metakognisi terhadap hasil belajar peserta didik. *Chemistry Education Review, 3*(1), 31–41.

Sugiyono. (2016). *Metode penelitian pendidikan pendekatan kualitatif, kuantitatif dan R&D*. Bandung: Alfabeta.

Trianto. (2011). *Mendesain model pembelajaran inovatif-progresif: Konsep, landasan, dan implementasinya pada Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Jakarta: Kencana Prenada Media Group.

Tamsyani, W. (2016). Pengaruh model pembelajaran dan kesadaran metakognitif terhadap hasil belajar peserta didik SMA dalam materi pokok asam basa. *Journal of Education Science and Technology*. 2(1), 10-15.

Uno, H. B. (2006). *Orientasi baru dalam psikologi pembelajaran*. Jakarta: Bumi Aksara

Wardana, R. W., Prihatini, A., & Hidayat, M. (2021). Identifikasi kesadaran metakognitif peserta didik dalam pembelajaran fisika. *PENDIPA Journal of Science Education, 5*(1), 1–9.

Widarto. (2013). *Penelitian ex post facto*. Fakultas Teknik: Universitas Negeri Yogyakarta.

Wilson, D. A., & Conyers, M. (2016). *Teaching students to drive their brains: Metacognitive strategies, activities, and lesson ideas*. Alexandria, VA: ASCD.

Yusnidah . (2020). Pengaruh gaya berpikir dan strategi pembelajran terhadap hasil belajar elektronika. *Journal of Natural Sciences*, 1(1),49-62.

Yulianti, T. (2015). Kemampuan metakognitif, lingkungan dan motivasi belajar meningkatkan prestasi akademik mahasiswa Poltekkes Bhakti Mulia. *IJMS – Indonesian Journal On Medical Science,* 2(1), 52-59.

Zakiah, & Khairi, F. (2019). Pengaruh kemampuan kognitif terhadap prestasi belajar matematika siswa kelas V SDN Gugus 01 Kecamatan Selaparang. *El Midad: Jurnal PGMI, 11*(1), 85–100.