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Increasing Students' Metacognition Awareness: Learning Studies Using Science Teaching Materials Based on SETS Integrated Inquiry

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Abstract

Metacognition awareness is a pivotal indicator in teaching and learning, particularly in science that needs to be developed in every student. This research aims to develop teaching materials particularly in the field of science using SETS (*Science, Environment, Technology, Society*) integrated inquiry to increase students' metacognition awareness. This study employed research and development procedure proposed by Dick & Carey. MAI (*Metacognition Awareness Inventory*) were used as research instruments, whilst N-gain being used to analyze the data of students' metacognition awareness. The results indicate that using science teaching materials based on SETS integrated inquiry can consider as an effective way to enhance students' metacognition awareness. It can be seen from the average value of N-gain score in experimental class higher than control class. The experimental class has an average value of N-gain of 0.48 which consider as moderate criteria, whereas in control class has an average value of N-gain of 0.25 which consider as low criteria. Besides, indicator of metacognitive awareness of "conditional knowledge" has the highest average N-gain scores compare to other indicators such as "procedural knowledge", "declarative knowledge", "planning", "information management", "information monitoring", "time strategy", and "evaluation". Furthermore, indicator of evaluation has the lowest average N-gain scores compare to other indicators. Thus, it can be concluded that using teaching materials based on SETS integrated inquiry can be considered as an effective way to increase students' metacognition awareness.

Keywords: Metacognition awareness, science teaching materials, inquiry, SETS.

1. Introduction

The main objective of education is helping students to take responsibility for their own learning. They have to be able to plan, monitor and evaluate their learning process [1]. To do this, they have to be metacognitively aware [2]. However, learning patterns that are oriented towards students' cognitive learning outcomes are still as a main concern of education experts to measure the quantity and quality of learning process. Learning and evaluation related to thinking skills have not received serious and planned attention [3]. Teachers are more active in learning activities as knowledge givers, therefore, students have a lot of knowledge, but if they are not trained to find concepts of knowledge that they have, it could be problems that will hinder the development of thinking skills to construct their knowledge [4, 5].

Learning that is oriented towards empowering thinking can be an alternative for students to understand learning process, specifically in the field of science. In the process

of achieving learning goals, many aspects that should be noted by teachers such as teachers can develop students' metacognition awareness [1]. Unfortunately, the ability of metacognition and high-level thinking is still rarely trained by teachers in learning process. This caused many students who have difficulty in learning [6]. Metacognition is a basic potential that needs to be owned and developed in every student because it becomes one of the important indicators of teaching and learning activities [7, 8, 9]. Metacognition is the cognitive ability needed to achieve deep and meaningful learning [9].

Metacognition received less attention when it played as an important role in solving learning problems, whilst O'Neil & Abedi [10] stated that metacognition is needed in solving learning problems. Metacognition is a higher mental process in learning, such as making learning plans, using proper skills and strategies to solve problems, making results estimation, and adjusting scope of learning [11]. Metacognition is an important aspect of student intelligence [12]. The intended of the metacognition development is to assist students to become critical thinkers who could implement an internal motivation and be independent in learning [13].

Moreover, metacognition is a complex psychological construction which includes knowledge and awareness about the process of cognition or knowledge about the mind and how it works [14]. Based on this definition, metacognition consists of two components, which are metacognition knowledge and metacognition awareness [1]. Metacognition knowledge refers to knowledge about cognition such as knowledge about skills and efficient work strategies for students on how and when to use the skills and strategies. Whereas, metacognition awareness refers to activities that control their own thinking and learning [15]. In this regard, metacognition is important in learning and determinant of student academic success [16, 17, 18, 19].

In respect of students with decent metacognition will be able to become independent learners, able to plan, monitor, and evaluate themselves in their own learning activities [20]. However, learning activities that can empower students' potentials, such as empowerment of metacognitive thinking which tends not to be implemented optimally, therefore, learning process becomes less meaningful [3]. Consequently, low-level of metacognition is in line with low- achievement of student in learning [13]. In this case, students who have low academic achievement can be improved through metacognition training [11].

Based on the characteristics of learning by empowering the metacognition awareness, it is expected to help optimizing the science learning process so that learning can be achieved optimally. Thus, it takes learning resources and learning models that support the purpose of its empowerment. Learning resources that must always be present in classroom activities are teaching materials which mainly used by understanding and applying it in teaching and learning process [21]. Related to that matter, one learning model that supports students to actively discover their knowledge is inquiry learning [22, 23, 24, 25]. Inquiry learning is a learning model designed to provide students with experience in applying scientific methods that emphasize the activities of asking questions, developing hypotheses to answer questions and testing hypotheses using inquiry data [26]. Therefore, the use of inquiry learning strategies in learning activities can improve students' metacognition abilities [27, 28].

Furthermore, one approach that has relevance to inquiry learning is Science, Environment, Technology, and Society (SETS). Teaching with SETS will be able to provide assistance to teachers in linking teaching materials with real-world situations and encouraging students to make connections between knowledge and its application in daily life [29]. In addition, SETS assists students in linking existing concepts with the environment surrounding, so that students can think critically to solve problems which they encounter [30].

Based on the discussion above, the problem that will be answered in this research is the effectiveness of using science teaching materials based on SETS integrated inquiry to increase students' metacognition awareness.

2. Methods

Method used in this study was research and development, particularly in the field of education by employing the procedure which have been developed by Dick & Carey [31]. Research and development is research methods used to produce certain products, and test the effectiveness of the products [32]. The products produced in this study are science teaching materials using SETS integrated inquiry to increase students' metacognition awareness. The procedure proposed by Dick & Carey consists of

. This study used two classes, which are experimental and control class. The experimental class was taught by using teaching materials based on SETS integrated inquiry, whilst the control class was taught using conventional teaching material (which is often used in schools).

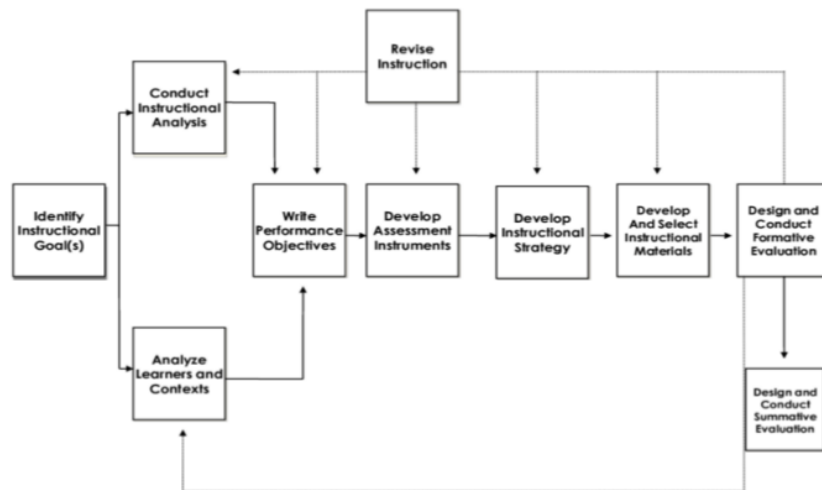


Figure 1. Research procedure based on Dick & Carey.

Population and sample in this study were nine grade junior high school students located in Mataram, Indonesia in academic year 2018/2019. The total number of samples were 60 students.

Data collection was carried out using the Metacognitive Awareness Inventory (MAI) questionnaire developed by Schraw & Dennison [33], which consisted of 52 questions. The data were quantitatively analyzed. Students' metacognition awareness was also measured based on the improvement of each indicator. Metacognition awareness indicators consist of declarative knowledge, procedural knowledge, conditional knowledge, planning, information management, information monitoring, Time strategy, and evaluation

This research was conducted during eight meetings, each meeting consists of 90 minutes of learning activities. Experimental class was taught using teaching materials based on SETS integrated inquiry, whilst control class was taught using a conventional model.

Data analysis used in this study was N-gain which can determine the effectiveness of teaching materials using SETS integrated inquiry. According to

Hake, [34], N-Gain could measure the increase of students' metacognition awareness. The answer selection instructions to each questionnaire item whether they use teaching materials based on SETS integrated inquiry are "yes" with scoring 1 which means implemented or "no" with scoring 0 which means not implemented. Criteria for interpreting the inventory of metacognition awareness according to Metcalfe & Greene in Arifin & Saenab [20] are presented in Table 1.

Table 1. Criteria for interpreting metacognition awareness inventory

Interval	Category
0-20	Very risky
21-40	Have not developed yet
41-60	Start to develop
61-80	Well-developed
81-100	Very well- developed

3. Result

This study has conducted a pre-test to determine students' metacognition awareness before they were given treatment followed by post-test to find out students' metacognition awareness after being treated. The treatment in experimental class was taught using science teaching materials based on SETS integrated inquiry, whilst control class was taught using conventional teaching materials. Examples of science teaching materials which have been developed are presented in Figure 2.



(a)



(b)



(c)

(d)

Figure 2. Examples of science teaching materials (a) cover of science teaching materials; (b) contents; (c) Inquiry activities (d) SETS activities.

After having the results of students' pre-test and post-test scores, an N-Gain analysis was then performed. The results of data analysis showed that the experimental class has an average value of N-Gain higher than the control class as shown in Table 2.

Tabel 2. The results of N- Gain score of metacognition awareness

Class	Pre-test	Post-test	N-gain	Category
Control	28,28	33,72	0,25	Low
Criteria of Metacognition awareness	Have not developed yet	Have not developed yet		
Eexperiment	30,15	41,15	0,48	Moderate
Criteria of metacognition awareness	Not quite developed yet	Started to develop properly		

Based on the results of metacognition awareness test presented in Table 2, in the experimental and control classes conveyed significant differences. The results of students' metacognition awareness tests in the experimental class showed an increasing number to medium category compared to the control class in the low category. This showed that the use of science teaching materials based on SETS integrated inquiry, particularly in experimental class, can increase students' metacognition awareness. Then, the results per-indicator analysis of students' metacognition awareness was obtained. The aspects of metacognition awareness measured in this study are of 2 dimensions, which are the dimension of cognition knowledge and regulation of cognition. Cognition knowledge consists of indicators of declarative knowledge, procedural knowledge and conditional knowledge, whilst cognition regulation consists of planning indicators, information management, information monitoring, Time strategy and evaluation. The results of students' metacognition awareness tests are presented in Table 3.

Tabel 3. Data on metacognition awareness of students per indicator

No	Dimension	Indicator	Pre-test	Post-test	N-gain
1	Cognition knowledge	Declarative knowledge	121	178	0,80
		Procedural knowledge	61	88	0,77
		Conditional knowledge	80	117	0,92
Total			262	383	2,49
2	Cognition	Planning	113	158	0,81

regulation				
	Information management	110	176	0,50
	Information monitoring	85	150	0,78
	Time strategy	98	113	0,75
	Evaluation	80	100	0,31
Total		486	697	3,15

Based on Table 3 above, it can be seen that the conditional knowledge indicator has the highest average N-gain score compared to other indicators such as declarative knowledge, procedural knowledge, planning, information management, information monitoring, time strategy, and evaluation. Other than that, evaluation indicator has the lowest average N-gain scores compared to other indicators. The results indicated that students' metacognition awareness has increased moderately significant after using teaching materials which have been developed using SETS integrated inquiry.

4. Discussion

There were an increasing number on students' metacognition awareness in the experimental and control class based on the N-gain value. The experimental class has an average value of N-gain with moderate improvement criteria, whilst the control class has an average value of N-gain with low increase criteria. This indicated that by applying science teaching materials based on SETS integrated inquiry in the experimental class can increase students' metacognition awareness. This is in line with previous study [35, 27], that students who used inquiry-based learning strategies can increase metacognition awareness, cognitive learning outcomes, motivate and stimulate students' curiosity in learning. In addition, through the use of science learning materials using inquiry models can be effective in improving students' higher-order thinking skills. One type of higher order thinking ability is metacognition ability [30, 36].

Through learning using SETS integrated inquiry materials in teaching and learning process, students and groups can discuss issues in a scientific manner with the aim of knowing the benefits and impacts that occur in the environment and society related to the application of science and technology. Interaction occurs between students that allows them to exchange ideas and opinions with each other through research or scientific procedures before they find the answers and the results that can train students' metacognition awareness. Learning activities with the SETS approach can improve students' problem-solving skills because learning activities are required students to solve problems in their environment. At the end of learning, students are expected to be able to master science teaching materials and also be able to solve problems critically [37]. This

is in accordance with research conducted by Nuray & Morgil [38] stated that science learning using SETS approach in experimental class can improve learning outcomes compared to learning using conventional models in the control class.

Learning using conventional teaching and learning materials in control class was dominated by lecturer, hence, students tend to feel bored and uninterested in learning and lack of effort to practice metacognition awareness. This is in accordance with research conducted by Suratno [6] stated that metacognition awareness cannot arise without treatment, and only focuses on methods that are dominated by lectures. In addition, Cao & Nietfeld [39] pointed out that metacognition does not appear by itself in learning process. The treatment given to the experimental class was in the form of learning using materials which have been developed by using SETS integrated inquiry.

Implementing SETS integrated inquiry learning models are suitable in learning science. It is proven that this learning assists students to understand the concepts learned, more enthusiastic and actively involved in teaching and learning activities. For teachers, this method requires a lot of abilities that must be possessed by them. For example, teacher have to master the materials, accustomed to think logically as a scientist, and having open-minded attitude (democratic), responsive to others, and willing to gain more knowledge in order to be a good educator [40]. Seraphin et al [41] discussed that metacognitive reflection using inquiry learning models has the potential to produce changes in scientific teaching and thinking, therefore, students could become critical thinkers and are more scientifically literate.

Metacognition awareness measured in this study consists of two components, which are cognition knowledge and cognition regulation. Cognition knowledge consists of three indicators such as declarative knowledge, procedural knowledge, and conditional knowledge. Furthermore, cognition regulation consists of five indicators, namely planning, information management, information monitoring, time strategy and evaluation. Based on the data presented in Table 3, the average value of N-gain metacognition awareness that experienced the highest increase was an indicator of conditional knowledge compared to other indicators such as procedural knowledge, declarative knowledge, planning, information management, information monitoring, time strategy, and evaluation. The lowest average N-gain value was an evaluation indicator.

The first indicator of metacognition awareness, the declarative knowledge has improved significantly, this is based on an overall number in pre- test scores which are 121 and increase significantly to 168 in a post-test. Declarative knowledge is knowledge that refers to self-knowledge about a matter, such as a student will solve a problem, know the concepts that will be used to solve the problem [42]. In addition, declarative

knowledge includes students who have prior knowledge and information materials that will be used to find out their intellectual skills and abilities [43].

The number of second indicator of metacognition awareness, namely procedural knowledge of students has increased based on the overall pre-test score which are 61 and rose notably in post-test which are 88. Procedural knowledge is knowledge that refers to knowledge about how to do an activity, this includes the knowledge of how to implement strategies and steps in carrying out an activity [42]. Procedural knowledge which includes the application of knowledge possessed by students for specific purposes such as completing and implementing learning procedures, students can obtain knowledge through group discussions [43]. In this indicator, one of the statements showed that students agree with it when they could understand science teaching materials through experiments and explanations of their peers. In using SETS integrated inquiry, teacher would formed a small group to discuss the problems that arise in the syntax of formulating the problem so that interaction occurs between students that allows them to exchange opinions.

The number of third indicator of metacognition awareness, students' conditional knowledge has increased significantly based on the overall score from pre-test which are 80 to 117 in post – test. Conditional knowledge is the ability of students who can determine when learning procedures / strategies are used and how students can gain knowledge through certain learning methods [43]. Metacognition awareness indicators for conditional knowledge has the highest score compared to other indicators such as procedural knowledge, declarative knowledge, planning, information management, information monitoring, time strategy, and evaluation. This study is in line with previous research conducted by Andriani et al [43], conditional knowledge indicators has the highest average scores than other indicators.

The fourth indicator of metacognition awareness, namely planning, which has pre-test overall score 113 increased in the post-test with an overall score of 158. Planning is the ability to plan learning activities before doing assignments [42].

The number of fifth and sixth metacognition awareness indicators, which are information management and information monitoring have improved, this is based on the number of average scores in pre- test which are 110 and notably increase in post-test with an overall score of 176. Also, the indicator of information management in the pre-test scores 85 and increased at post-test with an overall score of 150. Monitoring is the ability to monitor the learning process and matters related to the process [42].

The seventh indicator of metacognition awareness, which is time strategy. It is one important aspect in learning process of students. In study by Suratno [6] it was found that

students who were able to plan the estimated time needed to complete assignments, organize material, and take appropriate steps in learning were students who were aware of their abilities. The low number of the time strategy component score is caused by students' difficulty in managing their study time due to many activities in their school. This is based on complaints from students on researchers after learning process is finished. It was about the number of activities after class hours that make students difficult to manage their timetable. In addition, students have not been trained and are accustomed about how to know the process of metacognition awareness in learning, so that in changing the way of learning when failing to understand the material, students do not have opportunity to review materials that they have studied. This is relevant to study conducted by Abu et al., [44] that basically metacognition awareness is a personal assessment obtained by students not only in the learning process, but also influenced by several factors : (a) internal factors such as physical and spiritual conditions; (b) external factors such as environmental conditions around students; and (c) learning approach factors which are types of students' learning efforts. Therefore, much more attention is needed from teacher to be able to help students in the process of metacognition awareness and more specifically in time management strategies.

The eighth indicator of metacognition awareness is evaluation. It is an ability to evaluate the effectiveness of learning strategies, whether it will change its strategy, give up or end it [42]. The low score on the evaluation aspect is due to the lack of willingness and awareness of students to evaluate learning process. Students rely more on their learning outcomes being checked or evaluated by the teacher without looking back at how their knowledge and abilities actually are in the lesson. This is relevant to previous research by Widianingsih & Wulan's [45] claimed that the tendency of students to evaluate using imitation strategy, which is an evaluation from the teacher, where students trust their teacher more in evaluating each stage of their meta-logic, this is due to lack of students' confidence in the ability to evaluate their improvement in learning process. In this case, teacher can help and provide opportunities for students to reflect on their learning activities in order to help them be able to diagnose their weaknesses and strengths that can be used to improve learning timetable, learning strategies, and monitoring in learning process.

Therefore, students' metacognition awareness in learning does not appear in a short time and without any refraction to the empowerment of thinking but requires time and training with the help of teacher as a facilitator and environment surrounding as a supporter so that the training process of metacognition awareness can be achieved and carried out properly.

Thoroughly, based on table 3, it can be seen that the average value of students' metacognition awareness from each indicator after being taught using science teaching materials based on SETS integrated inquiry has notably increased, it is due to the treatment that being given during the learning process. In this study, mostly, the increasing number on students' metacognition awareness being supported by the syntax inquiry. For example, the syntax of formulating problems and collecting data. In the aspect of formulating the problem, it occurs due to the stimulus provided by teacher, then, students' will come up with questions that will become purpose of learning. If the questions raised by students do not meet the expectations which have been set by teacher, to overcome this case, teacher need to provide questions that will lead students to important questions that are in line with learning objectives that have been designed. In the steps of formulating hypotheses, students are asked to formulate hypotheses based on information that they already have. This hypothesis must be tested later. To proceed to this stage, students, have to start collecting data or information that is needed and relevant [26]. Inquiry activities assist students to develop their individual, responsibility, learning to be independent in accordance with student learning styles, make scientific reports, and practice problem solving skills [46]. In the inquiry learning model, teachers and students play an important role in learning, the teacher facilitates students to ask questions and develop proper answers. This can increase students' metacognition awareness.

The characteristics of inquiry learning models can give students the responsibility to carry out learning independently from the beginning of learning process. Based on the inquiry learning cycle, at the stage of inquisition, students have been asked to compile the problems of the experiment, and proceed to the next stage, which is the stage of drafting and implementing the experiment and also taking and summation or processing data [23]. From these stages, they were asked to draw up their own experimental designs then process the results to produce conclusions [47]. Kipnis & Hofstein [48] stated that when conducting inquiry activities, students practice their metacognitive abilities at various stages of inquiry process. By giving a great responsibility will encourages students to be more active in learning activities, therefore, they will be able to complete the tasks in time. This is in line with the opinion from Yusnaeni et al., [49] which stated that giving responsibility to students for independent learning, as what students in experimental class have done will help them increase their metacognition awareness.

This study has several limitations: (1) the developed teaching materials is focused only about human reproduction system in grade nine at Junior high school; and (2) this study only use one school as a sample.

5. Conclusion

It can be concluded that learning using science teaching materials based on SETS integrated inquiry can increase students' metacognition awareness. This can be seen from the N-gain test results of the experimental class which notably increased by 0.48 in the medium category, whilst the control class experienced of 0.25 in the low category. Metacognition awareness indicators for conditional knowledge has the highest average N-gain score compared to other indicators such as procedural knowledge, declarative knowledge, planning, information management, information monitoring, time strategy, and evaluation. However, evaluation indicator has the lowest average N-gain scores compared to other indicators. Based on the results and discussions, science teaching materials using SETS integrated inquiry have a positive impact on students' metacognition awareness. The authors suggest that science teaching materials can be collaborated with other learning models according to the characteristics of the materials chosen. In addition, further research needs to be done to find out the effect of the use of science teaching materials on other high-level thinking skills, such as critical thinking, creative thinking, and scientific literacy.

References

- [1] M. Mahdavi, "An overview: Metacognition in education, *International Journal of Multidisciplinary and Current Research*", vol. 2, no. 6, (2014), pp. 529-535.
- [2] DJ Hacker, J Dunlosky and AC Graesser, "Handbook of Metacognition in Education", New York: Routledge, (2009)
- [3] M Danial, "Kesadaran Metakognisi, Keterampilan Metakognisi Dan Penguasaan Konsep Kimia Dasar", *Jurnal Ilmu Pendidikan.*, vol. 17, no. 3, (2016), pp. 225-229.
- [4] S Hadisaputra, G Gunawan, and M Yustiqvar, "Effects of Green Chemistry Based Interactive Multimedia on the Students' Learning Outcomes and Scientific Literacy", *Journal of Advanced Research in Dynamical and Control Systems*, vol. 11, no. 7, (2019), pp. 664-67.
- [5] G Gunawan, R Mashami, and L Herayanti, "Gender Description on Problem-Solving Skills in Chemistry Learning Using Interactive Multimedia", *Journal for the Education of Gifted Young Scientists*, vol. 8, no. 1, (2020), pp. 571-588
- [6] Suratno, "Kemampuan Metakognisi dengan Metacognitive Awareness Inventory (MAI) pada Pembelajaran Biologi SMA dengan Strategi Jigsaw, Reciprocal Teaching (RT), dan Gabungan Jigsaw-RT", *Jurnal Pendidikan Dan Pembelajaran*, vol. 18, no. 1, (2011), pp. 11-18.
- [7] A Efklides, "Metacognition and affect: What can metacognitive experiences tell us about the learning process?", *Educational research review*, vol. 1, no. 1, (2006), pp. 3-14.
- [8] GP Thomas, "Metacognition in science education: Past, present and future considerations", *In Second international handbook of science education*, Springer, Dordrecht. (2012), pp. 131-144
- [9] DR Garrison, and Z Akyol, "Toward the development of a metacognition construct for communities of inquiry", *The Internet and Higher Education*, vol. 24, (2015), pp. 66-71.

- [10] HF O'Neil Jr and J Abedi, "Reliability and validity of a state metacognitive inventory: Potential for alternative assessment", *The Journal of Educational Research*, vol. 89, no. 4, (1996), pp. 234-245.
- [11] SA Coutinho, "The Relationship Between Goals Metacognition and Academic Success", *Educate*, vol. 7, no. 1, (2007), pp. 39-47
- [12] Z Akyol and Garrison, D. R, "Assessing metacognition in an online community of inquiry", *The Internet and Higher Education*, vol. 14, no. 3, (2011), pp. 183-190.
- [13] N Hayati, "Peningkatan Kesadaran Metakognitif Dan Hasil Belajar Peserta didik SMA Melalui Penerapan Diagram Roundhouse Dipadu Model pembelajaran CIRC Ed-Humanistics", *Jurnal Ilmu Pendidikan*, vol. 1, no. 1, (2016), pp. 44-55
- [14] KF Thomas and MA Barksdale-Ladd, "Metacognitive processes: Teaching strategies in literacy education courses", *Journal Reading psychology*, vol. 21, no. 1, (2000), pp. 67-84.
- [15] R Negretti, "Metacognition in student academic writing: A longitudinal study of metacognitive awareness and its relation to task perception, self-regulation, and evaluation of performance", *Written Communication*, vol. 29, no. 2, (2012), pp. 142-179.
- [16] R Azevedo, "Theoretical, conceptual, methodological and instructional issues in research on metacognition and self-regulated learning: A discussion", *Metacognition and Learning*, vol. 4, no. 1, (2009), pp. 87-95.
- [17] G Schraw, "A conceptual analysis of five measures of metacognitive monitoring", *Metacognition and learning*, vol. 4, no. 1, (2009), pp. 33-45.
- [18] M Veenman, B Van Hout-Wolters, and P Afflerbach, "Metacognition and learning: Conceptual and methodological considerations", *Metacognition and Learning*, vol. 1, (2006), pp. 3-14.
- [19] PW Stewart, SS Cooper, and LR Moulding, "Metacognitive development in professional educators". *The Researcher*, vol. 21, no. 1, (2007), pp. 32-40.
- [20] NA Arifin and S Saenab, "Perbandingan Kesadaran Metakognitif Peserta didik yang Diajar Menggunakan Model Problem-Based Instruction (PBI) dengan Kooperatif Tipe Think Pair Share (TPS)", *Jurnal Bionature*, vol. 15. No. 2, (2014), pp. 81-89.
- [21] S Windyariani, Setiono and A Sutisnawati, "Pengembangan Bahan Ajar Berbasis Konteks dan Kreativitas untuk Melatihkan Literasi Sains Peserta Didik Sekolah Dasar", *Jurnal Bioedukatika*, vol. 4, no. 2, (2016), pp. 19-25.
- [22] M Novitaningrum, Parmin and DS Pamelasari, "Pengembangan Handout IPA Terpadu Berbasis Inkuiri Pada Tema Mata Untuk Kelas IX Peserta didik MTs Al-Islam Sumurejo". *Unnes Science Education Journal*, vol. 3, no. 2, (2014), pp. 542-548.
- [23] A Ramdani and IP Artayasa, "Keterampilan Berpikir Kreatif Mahasiswa Dalam Pembelajaran Ipa Menggunakan Model Inkuiri Terbuka", *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, vol. 8, no. 1, (2020), pp. 1-9.
- [24] M Yasin, D Jauhariyah, M Madiyo, R Rahmawati, F Farid, I Irwandani and F Mardana, "The Guided Inquiry to Improve Students Mathematical Critical Thinking Skills Using Student's Worksheet", *Journal for the Education of Gifted Young Scientists*, vol. 7, no. 4, (2019), pp. 1345-1360
- [25] K Chandra, I Degeng, D Kuswandi and P Setyosari, "Effect of Guided Inquiry Learning Model and Social Skills to the Improving of Students' Analysis Skills in Social Studies Learning". *Journal for the Education of Gifted Young Scientists*, vol. 8, no. 1, (2020), pp. 603-622.
- [26] P Eggen and D Kauchak, "Strategies and Models for Teachers: Teaching Content and Thinking Skills Six Edition", Pearson Higher Ed. (2012).

- [27] M Fitriana and S Haryani, "Penggunaan Strategi pembelajaran Inkuiri Untuk Meningkatkan Metakognisi Peserta didik SMA", *Jurnal Inovasi Pendidikan Kimia*, vol. 10, no. 1, (2016), pp. 1702-1711.
- [28] M Zion, T Michalsky and ZR Mevarech, "The effects of metacognitive instruction embedded within an asynchronous learning network on scientific inquiry skills", *International Journal of Science Education*, vol. 27, no. 8, (2005), pp. 957-983.
- [29] A Rasyid, "Pengembangan Perangkat Pembelajaran Biologi Bervisi SETS Kompetensi Ekologi Dan Kerusakan Lingkungan Sekolah Menengah Atas", *Jurnal Bio Education*, vol. 2, no. 2, (2017), pp. 09-17.
- [30] EA Ningtyas, W Sumarni and W Christijanti, "Pengembangan Modul IPA Terpadu Berbasis SETS Dengan Tema Hujan Asan Untuk Kelas VII SMP", *Unnes Science Education Journal*, vol. 3, no. 1, (2014), pp. 438-444.
- [31] W Dick, L Carey, and JO Carey, "The Systemic Design of Instruction", Montreal, (2009)
- [32] Sugiyono, "Metode Penelitian Kualitatif Kuantitatif dan R & D", Bandung: Alfabeta, (2017).
- [33] G Scharw and RS Dennison, "Assessing Metacognitive Awareness", *Contemporary Educational Psychology*, vol. 19, (1994), pp. 460-475.
- [34] RR Hake, "Analyzing Change/Gain Score". USA: Dept.Of Physics Indiana University. (1999).
- [35] NW Anggraeni, NP Ristiati and NLPM Widiyanti, "Implementasi Strategi Pembelajaran Inkuiri terhadap Kemampuan Berpikir Kritis dan Pemahaman Konsep IPA Siswa SMP", *e-Journal Program Pascasarjana Universitas Pendidikan Ganesha*, vol. 3, no. 1, (2013), pp. 1-11.
- [36] L Yulianti, "Efektivitas Bahan Ajar IPA Terpadu Terhadap Kemampuan Berpikir Tingkat Tinggi Siswa SMP", *Jurnal Pendidikan Fisika Indonesia*, vol. 9, no. 2, (2013), pp. 53-57
- [37] U Usmeldi, R Amini and S Trisna, "The Development of Research-Based Learning Model with Science, Environment, Technology, and Society Approaches to Improve Critical Thinking of Students", *Jurnal Pendidikan IPA Indonesia*, vol. 6, no. 2, (2017), pp. 318-325.
- [38] Y Nuray and I Morgil, "The effects of science, technology, society, environment (STSE) interactions on teaching chemistry", *Natural science*, vol. 2, no. 12, (2010), pp. 1417.
- [39] L Cao and JL Nietfeld, "College Students' Metacognitive Awareness of Difficulties in Learning the class Content Does not Automatically Lead to Adjustment of Study Strategies", *Australian Journal of Educational & Development Psychology*, vol. 7, (2007), pp. 31-46.
- [40] S Ayub, G Gunawan, A Ramdani and G Afifah, "Student Oriented Learning In Floating and Drowning Concept", *IOP Conf. Series: Journal of Physics: Conf. Series*, 1471, 012062, (2020).
- [41] KD Seraphin, J Philippoff, L Kaupp and LM Vallin, "Metacognition as means to increase the effectiveness of inquiry-based science education", *Science Education International*, vol. 23, no. 4, (2012), pp. 366-382.
- [42] GP Thomas and Mc.Robbie, "Using a Metaphor for Learning to Improve Student' Metacognition in the Chemistry classroom", *Journal of research in Science Teaching*, vol. 38, no. 2, (2001), pp. 222-259.
- [43] A Andriani, BR Rudibyani and E Sofya, "Pembelajaran Discovery Learning untuk Meningkatkan Kemampuan Metakognisi dan Penguasaan Konsep Peserta didik", *Jurnal Pendidikan dan Pembelajaran Kimia*, vol. 6, no. 2, (2017), pp. 308-320.
- [44] NHS Abu, NA Rahman and Gustina, "Pengaruh Strategi Pembelajaran Terhadap Kesadaran Metakognitif dan Hasil Belajar Peserta didik Kelas XI IPA SMAN 13 Makassar pada Materi Sistem Koloid", *Jurnal Chemical*, vol. 16, no. 1, (2015), pp. 37 - 46.

- [45] AA Widianingsih and RA Wulan, "Pengaruh Strategi Metakognisi terhadap Penguasaan Konsep dan Sikap Ilmiah Peserta didik Kelas XI dalam Pembelajaran Sistem Reproduksi Manusia", *Seminar Nasional XII Pendidikan Biologi FKIP UNS*, SP-006-3, (2015), pp. 297-302.
- [46] I Bilgin, "The effects of guided inquiry instruction incorporating a cooperative learning approach on university students' achievement of acid and bases concepts and attitude toward guided inquiry instruction", *Scientific research and essay*, vol. 4, no. 10, (2009), pp. 1038-1046.
- [47] D Llewellyn, "*Differentiated science inquiry*". California: Corwin, A Sage Company, (2011).
- [48] M Kipnis and A Hofstein, "The inquiry laboratory as a source for development of metacognitive skills", *International Journal of Science and Mathematics Education*, vol. 6, no. 3, (2008), pp. 601-627.
- [49] Yusnaeni, AD Corebima, H Susilo and S Zubaidah, "Creative Thinking of Low Academic Student Undergoing Search Solve Create and Share Learning Integrated with Metacognitive Strategy", *International Journal of Instruction*, vol. 10, no. 2, (2017), pp. 245-262.

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