Analysis metacognitive skills of junior high school students on nervous system material with different academic skills

E Jakiyah[1], Suratno[2] and J Waluyo[3]

[1,2,3] Magister Science Education, Faculty of Teacher Training and Education, UniversityJember, Indonesia

suratno.fkip@unej.ac.id

Abstract.Nervous system material is very complicated to learn so it needs thinking skills to develop understanding and improve cognitive performance that is using metacognitive skills. The purpose of this study is to analyze the metacognitive skills of junior high school students on regulation system material with different academic abilities.This research is a qualitative descriptive study. The research method uses a mix method (qualitative and quantitative). Qualitative data in the form of descriptive based on observations. Quantitative data are in the form of the MAI (Metacognitive Awareness Inventory) test based on MAI indicators, namely Knowledge About Cognition and Regulation of Cognition. This study into 3 categories, namely students with high, medium and low academic abilities. The results of the metacognitive research with high academics obtained an average value of 59.45, metacognitive with moderate academics obtained an average value of 60.44 and metacognitive with low academics obtained an average value of 59.45

1. Introduction

The material of the nervous system is very important to learn because all activities are coordinated by nerves. In studying the nervous system can be developed in real life but on the mechanism of the nervous system many students have difficulty because too much information must be absorbed and a lot of complicated processes that must be understood, therefore understanding is needed to develop the concepts of studying the nervous system material. Many students cannot develop their understanding of the concepts of the nervous system because between the acquisition of knowledge and the process is not well integrated so that many students have difficulty in the learning process [1] and [2]. The current learning process requires students to develop thinking skills through experience [3]. One of these skills is metacognitive skills to help students think and choose learning strategies in understanding the mechanism of the nervous system. Metacognitive skills are basically already possessed by human beings themselves, metacognitive is the awareness of thinking on one's ability to learn that includes how well learning is done, what is and is not yet known [4], this is appropriate for studying the nervous system material because there are many the process in it that must be understood. Metacognition consists of three aspects, namely planning, monitoring and evaluation [5].

Metacognition as one of the 21st century skills is very important to be taught to produce independent students [6]. Previous research conducted by [7] that metacognitive skills can help students develop thinking skills, problem solving and involvement in thinking so students have high memory. In research [8] metacognition skills can improve students' reasoning skills. In Jang's [9] research metacognition skills represent ways of teaching that increase student autonomy and involvement but teacher pays less attention to differences in students' academic abilities.

The level of learning success can be influenced by different academic abilities [10]. So far, metacognitive skills in learning nervous system material with different academic abilities have not

received attention even though different academic achievement of students is influenced by their ability to manage metacognition [11]. The teacher must strive for students to achieve the abilities set by the curriculum. Based on this description, it is necessary to analyze metacognitive skills in learning science with different academic abilities.

2. Methodology

The population of this research is the XI grade students of SMP in Banyuwangi with a sample of 130 students. Students in one sample class are given daily test questions about the nervous system that must be solved using problem solving methods that aim to explore students' metacognitive skills. Data collection techniques using test techniques to measure metacognitive skills, namely MAI (Metacognitive Awarness Inventory) test based on MAI indicators, namely Knowledge About Cognition, Monitoring and Evaluation. The assessment instrument uses a Likert scale from 1 to 4, from strongly disagreeing to strongly agreeing. MCA-I scores in the form of a mean in each category of academic ability (high, medium and low) then the test results are sorted by highest to lowest, where the higher the value of metacognitive skills the better.

Data analysis on this research is quantitative and qualitative (mix method). Quantitative data is generated from the MAI (Metacognitive Awareness Inventory) test results. Analysis of the results of the MAI (Metacognitive Awarness Inventory) test is then presented based on aspects that are examined with different academic abilities. The qualitative data generated in the form of descriptions of student answers from different academic abilities is presented based on MAI indicators. The criteria for academic grouping can be seen in the following table:

Table 1. Grouping academic categories.

Category	Criteria
80 - 100	Low
50 – 79	Medium
0 – 49	High

In the three groups of academic abilities, 1 student was chosen as the research subject to be chosen by considering students' ability to answer the problem solving of the nervous system material based on metacognitive indicators, namely planning, monitoring and evaluation [12]

3. Result

Three aspects of metacognitive skills measured include planning (planning), monitoring (monitoring), and evaluation (evaluation) obtained as follows.

Table 2. Results of analysis of metacognition skills per aspect.

	N	Minimum	Maximum	Mean	Std. Deviation
knowledge	130	25	88	59,38	14,914
monitoring	130	25	94	59,28	12,529
evaluation	130	30	90	59,19	13,393
Valid N (listwise)	130				

The MAI (Metacognitive Awarness Inventory) test is used to see the level of metacognitive skills students have. The level of metacognitive skills of students is seen by conserving the scores obtained in each aspect. In the aspect of knowledge the highest average of 59.38 is obtained because in this aspect students can provide information based on what they know: On the monitoring aspect an average of 59.28 students was obtained, many of which had not used the learning strategy in solving

problems, while on the Evaluation aspect an average of 59.19 students had not yet introspected themselves to review what was done.

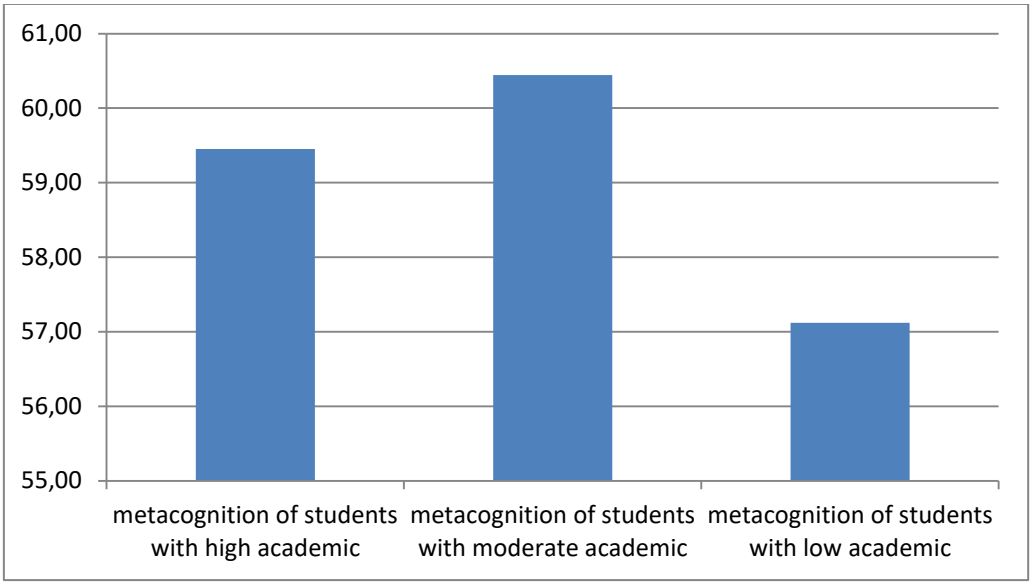

Figure 1. Metacognitive skills with different academics.

Metacognitive skills are analyzed based on different academic scores using daily test scores on learning science in the nervous system material. Metacognitive students with high academic values obtained an average value of 59.45, metacognition of students with moderate academic values obtained an average value of 60.44 and metacognition with low academic values obtained an average value of 57.12.

4. Discussion

This is the same as research conducted by [13] that students who have high critical thinking skills have high metacognitive skills. From these three categories, 1 student was chosen to be the subject of research in answering questions about the nervous system to analyze their metacogical skills. This research analyzes metacognition skills with different academic activities, given test questions on the material of the nervous system as follows:

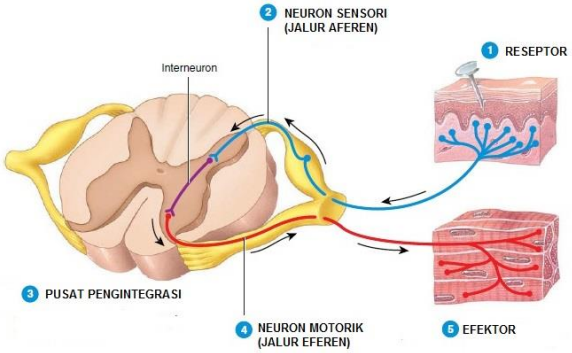

Figure 2. Mechanisms of reflex motion.

In reflex motion, impetus that comes from the receptor is not all the way to the brain, in the picture the short path that is crossed by excitatory causes reflex motion. This type of reflex is related to the connecting nerve. Students are given a test about the material of the nervous system in Figure 1. Below will be explained aspects of students' metacognitive skills based on different academics.

4.1. Metacognition of students with high academic

In this study one of the answers chosen from 1 student who has high academic ability is a student with a value of 100.

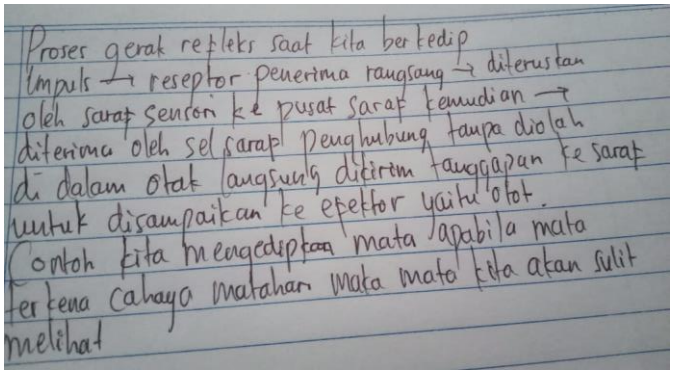

Figure 3. Subject's answer 1.

Here are the answers to students subject of the answers chosen from 1 student who has high academic ability is a student with a value of 100. Here are the answers to students subject of the answers chosen from 1 student who has high academic ability is a student with a value of 100. Here are the answers to students subject of the answers chosen from 1 student who has high academic ability is a student with a value of 100. Here are the answers of students.

4.2. Metacognition of students with medium academic

In this study one of the answers chosen from 1 student who has moderate academic ability is a student with a value of 70. Following are the answers of students.

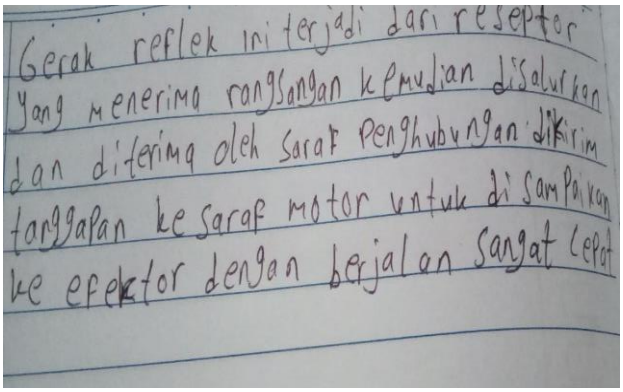

Figure 4. Subject's answer 2.

In the planning aspect, students can provide information and find out the type of information that is most important for learning. Students can remember information well by writing down information they know. In the aspect of monitoring the student can explain what he is doing correctly and what he first did. Students also use strategies to be able to understand the mechanism of reflex motion by explaining the mechanism of reflex motion. In the aspect of evaluation students still do not realize the importance of the material of the nervous system in everyday life so that the students' answers are not given examples of the events of the reflex motion in everyday life. This study is the same as research conducted by [14] that metacognitive with moderate academic still does not meet the metacognitive indicators in the evaluation aspect.

4.3. Metacognition of students with low academic

In this study one of the answers chosen from 1 student who has moderate academic ability is a student with a value of 40. Following are the answers of students.

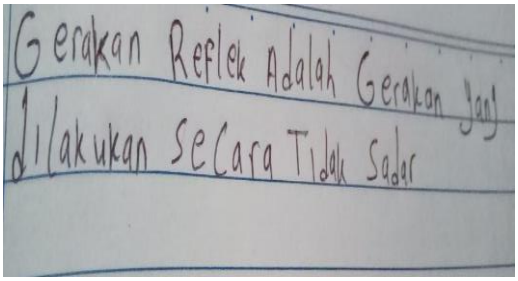

Figure 5. Subject's answer 3.

In the planning aspect, students can provide information but are not written correctly, this has not fully met the metacognitive indicators on the planning aspect. In the aspect of monitoring students are not been able to choose strategies to solve problems so they do not meet the metacognitive indicators on the monitoring aspects. In the aspect /of evaluation students still do not realize the importance of the material of the nervous system in everyday life so that the students' answers are still in the form of understanding, thus students have not met the metacognitive indicators in the evaluation aspect From the results of this study have similarities with research conducted by [15] and [16] that the academic ability of students regarding metacognitive awareness is more dominant in the medium criteria, while the average ability of metacognitive awareness is in the low category.

5. Conclusion

Based on the research results obtained metacognitive skills of students with high academics obtained an average value of 59.45, metacognitive students with moderate academics obtained an average value of 60.44 and metacognitive students with low academics obtained an average value of 59.45. Students with high academic ability meet metacognitive skills indicators in aspects of planning, monitoring and evaluation. Students with academic abilities are meeting indicators of metacognitive skills in the planning stage, but have not fully met indicators of metacognitive skills in the aspects of monitoring and evaluation, while students who have low academic ability have not met indicators of metacognitive skills in aspects of planning, monitoring and evaluation in solving problems in the material nervous system**.**

6. Acknowledgment

We would like to say our biggest gratitude for all parties who have provided the writer valuable information. Specifically, the writer would like to state thankfulness for Jember University the writers' institution

References

[1] Asy'ari, M 2019 The Effectiveness of Inquiry Learning Model in Improving Prospective Teachers' Metacognition Knowledge and Metacognition Awareness *International Journal of Instruction* **12(2)** e-ISSN: 1308-1470

[2] Braund, H 2018 Elementary students as active agents in their learning: an empirical study of the connections between assessment practices and student metacognition *Elementary students as active agents in their learning*, https://doi.org/10.1007/s13384-018-0265-z.

[3] Coşkun, Y 2018 A Study on Metacognitive Thinking Skills of University Students *Journal of Education and Training Studies* E-ISSN 2324-8068

[4] Dinkel, D. M 2016 Examining the Knowledge and Capacity of Elementary Teachers to Implement Classroom Physical Activity Breaks *International Electronic Journal of*

Elementary Education p 182-196
[5] Fani, T 2017 Multistation exercises: a combination of problem-based learning and team-based learning instructional design for large-enrollment classes *Procedia - Social and Behavioral Sciences 29* p 424–428
[6] Gok, T 2018 The Evaluation of Conceptual Learning and Epistemological Beliefs on Physics Learning by Think-Pair-Share *Journal of Education in Science, Environment and Health* , 69-80. DOI:10.21891/jeseh.387489
[7] Gok, T 2018 The Evaluation of Conceptual Learning and Epistemological Beliefs on Physics Learning by Think-Pair-Share *Journal of Education in Science, Environment and Health (JESEH)* **4(1)** 69-80. DOI:10.21891/jeseh.387489
[8] Indri Pratiwi, S M 2016 Improvement of Metacognition Ability and Student Learning Outcomes by the Process Skill Approach through Think Pair Share in Class X-3 Students of SMAN Yosowilangun Lumajang Year 2014/2015 *Edukasi* p 22-28
[9] Kulak, V 2017 Does the Use of Case-based Learning Impact the Retention of Key Concepts in Undergraduate Biochemistry *International Journal of Higher Education* **6 (2)**
[10] Purnomo, D 2017 The Characteristic of the Process of Students' Metacognition in Solving Calculus Problems *International Education Studies*, Vol. 10, No. 5; E-ISSN 1913-9039
[11] Rezaei, A. R 2015 Frequent collaborative quiz taking and conceptual learning. *Active Learning in Higher Education* **16(3)** p 187 –196
[12] Rodriguez, V 2013 The Human Nervous System: A Framework for Teaching and the Teaching Brain Mind, Brain, and Education **7(1)** p 2–12 doi:10.1111/mbe.12000
[13] Singh, N 2018 Multistation exercises: a combination of problem-based learning and team-based learning instructional design for large-enrollment classes *Generalizable Education Research*, **42** p 424–428
[14] Stanton, J. D 2019 Knowledge of Learning Makes a Difference: A Comparison of Metacognition in Introductory and Senior-Level Biology Students *Journal Sciences Education* 18-12-0239
[15] Suratno., Dian, K 2018 The Analysis of Higher Order Thinking Skills in Solving the Real Problem of the Coffee Plantation Area Students *Journal of Computational and Theoretical Nanoscience* **24(4)** p 2199-2202 doi:10.1166/asl.2018.12030
[16] Suratno., Komaria, N., Yushardi., Dafik., Wicaksono, I 2019 The Effect of Using Synectics Model on Creative Thinking and Metacognition Skills of Junior High School Students. *International Journal of Instruction* p 133-150 doi:10.29333/iji.2019.1239