Metacognitive knowledge of mathematics education students in analytical geometry of space

Sutama¹, S Anif², H J Prayitno³, D P Sari⁴
Mathematics Education, Universitas Muhammadiyah Surakarta¹,⁴
Biological Education, Universitas Muhammadiyah Surakarta²
Linguistic Education, Universitas Muhammadiyah Surakarta³
E-mail: sutama@ums.ac.id

Abstract. This research aims to describe metacognitive knowledge of mathematics education students in open start problem solving. This research was qualitative research. The research subject was mathematics education students of Universitas Muhammadiyah Surakarta in academic year 2018/2019. The selected students consisted of 6 students, i.e. two subjects of intrapersonal intelligence with category high, intermediate, and low. The research instruments were questionnaire, open start problem solving task, and interview guidelines. Data validity used time triangulation. Data analyses were done by collecting data, reducing data, presenting data, and drawing conclusion. Based on findings, subjects with high intrapersonal intelligence have positive dominant character, i.e. able to do planning step appropriately and had high self-confidence that they were able to solve the problem, so their answer is correctly. Subjects with intermediate intrapersonal intelligence had high self-assessment but they unable to carrying out the plan properly, so that it resulted inaccurate. Subjects with low intrapersonal intelligence absolutely sure that their answer was correct, but he can not explain for their problem solving steps because they not yet introspection and had not fix the shortcomings that are owned, so their task result inaccurate.

1. Introduction
Problem solving is a higher-order cognitive process. Problem solving may include systematic process of an individual’s critical thinking skills [23]. This process indicates the sequence of activity that must be passed. Thinking process in mathematics learning is an important thing, and teachers should concern about it. The reason is students expected to develop their ability in problem solving, either in the real problems or mathematical problems. Hence, problem solving in mathematics learning was necessary thing and should be carried out by students [22]. The reason is mathematics has clear structure and linked concepts that make learners have possibilities to be competent in solving every single problem [1].

Polya [19] explain that “To get optimal result in problem solving, there are several problem solving steps that should be well-organized used, i.e. (1) Understanding the problem; (2) Devising the plan; (3) Carrying out the plan; and (4) Looking back”. This procedure will organize one’s structured mindset well.

In overcoming a matter, awareness was needed for using strategy and conducting control in every action to reach appropriate solution [14]. Individual awareness in using strategy and conducting control to achieve right problem solving is inseparable from the role of metacognitive knowledge. Flavell [9] defines that metacognitive knowledge is a knowledge of individual and others as cognitive
agent, task, action, or strategy, and how all of those aspects interact and affect the result of any kinds of intellectual effort. Metacognitive knowledge is important aspect in solving a problem. Metacognitive knowledge is explicit or implicit knowledge of an individual about how to do something in order to have a proper problem solving [20]. In line with [20], Panchu, Bahuleyan, Seethalakshmi, & Thomas [17] state that metacognitive knowledge is an individual ability of the usage of strategy and within a condition of how that strategy being conducted in solving a problem.

There are four kinds of knowledge dimensions which are hierarchically arranged, namely factual knowledge, conceptual knowledge, procedural knowledge, and metacognitive knowledge. Factual knowledge contains core elements that have to be individually known if they were introduced to a discipline or to overcome any problem within. Conceptual knowledge includes schemes, models, and theories where it indicates knowledge possessed by someone about how a certain topic is set and arranged, how different pieces of information interconnect more systematically, and how the pieces work together. Procedural knowledge is knowledge of how to conduct something including knowledge about algorithms, techniques, and collective methods named as procedure. Metacognitive knowledge is knowledge about awareness, generally as same as alertness and knowledge about self-awareness (self-knowledge). Metacognitive knowledge is the highest degree of knowledge dimensions [3].

Definition of knowledge dimensions is also stated by Jacob & Paris [13] who categorizes three knowledge arranged hierarchically, those are declarative knowledge, procedural knowledge, and conditional knowledge. Declarative knowledge is a knowledge about what is known in something being discussed. Procedural knowledge explains knowledge about awareness and thinking process. Conditional knowledge discusses about conditions and tasks until one understood why a procedure and how the way the condition is going.

Factual and conceptual knowledge explained by Anderson & Krathwohl [3] above are elaboration of declarative knowledge stated by Jacob & Paris [13], while metacognitive knowledge viewed by Anderson & Krathwohl [3] is elaboration of conditional knowledge stated by Jacob & Paris [13]. Anderson & Krathwohl [3] explain further the existence of self-knowledge component in metacognitive knowledge when [13] do not mention it yet in conditional knowledge.

Based on previous theory, metacognitive knowledge is at the highest level in the dimension of knowledge. Therefore, metacognitive knowledge covers its subordinate knowledge. In this study, metacognitive knowledge includes declarative knowledge, procedural knowledge, conditional knowledge, and self-knowledge. Declarative knowledge is knowledge with the form of fact (including terms or symbols) where the different pieces of information are able to connect and link each other more systematically in solving a problem. Procedural knowledge is knowledge relating to how to use things known in declarative knowledge in his or her learning activity. Procedural knowledge explains about how to use a procedure, skill, or strategy, and how if those things mentioned are not be used; why a procedure and how the way the condition is going. Self-knowledge indicates self-understanding toward certain strategies which are effective and able to accomplish the problem well.

Metacognitive knowledge was needed when individuals solve the problem. Individuals who use metacognitive knowledge are effective when solve the problem, this is because metacognitive knowledge helps someone in identifying problem that needs to be solved, discovering what the real problem, and knowing how to achieve the goal or solution [15]. Therefore, students are expected to have good understand about metacognitive knowledge. Anggo [4] state that “the use of challenging and non-routine characteristics is one of factor that can stimulate metacognitive knowledge in problem solving. One of the problems that has challenging and non-routine characteristics is open start. It is because the students do not know find the result directly when solve open start problem [16]. Indicator of metacognitive knowledge for this research, i.e. (1) Declarative knowledge: students are aware to knowing the meaning of symbols and the terms written, able to connecting the information obtained in the problem with their basic knowledge, and able to using the formula correctly; (2) Procedural knowledge: students are aware to knowing the relationships between a formulas with another formula and knowing how to apply it, and able to knowing the problem solving steps in general; (3) Conditional knowledge: students are aware to knowing what strategies are used and how to use it; (4)
Self knowledge: students are aware to using strategy appropriately, and able to explaining the reasons for the chosen strategy.

We know that matter on analytical geometry of space has the same characteristics with open start problem. The reason is matter on analytical geometry of space has various way with one correct answer. Hence, analytical geometry of space is one of problems that can stimulate metacognitive knowledge for mathematics education students. The researcher conducted research of document analysis of score on analytical geometry of space in academic year 2016/2017 and 2017/2018 Universitas Muhammadiyah Surakarta. The result of document analysis in 2016/2017 and 2017/2018 evince 34% and 37% of students get final score less than 56. These results show that many students do not understand about metacognitive knowledge which makes them lack of capability in identifying declarative, procedural, conditional, and self-knowledge so that it causes students get low score. The researcher also conducted task based interview to get more about the problem of mathematics education students in analytical geometry of space. The result indicates that students do not understand yet why a procedure and how the way the condition is going, so that the task completing does not lead to the correct answers. It indicates that the individual performance depends on how optimum the students in connecting their basic knowledge to information gained from the problem. The knowledge is able to be optimum when someone can decide strategy in problem solving. The strategy arises when someone can understand her or himself well. The individual’s ability to understand himself is called intrapersonal intelligence.

Intrapersonal intelligence is self-knowledge and the ability to act adaptively on the basis of that knowledge [5]. This intelligence includes having an accurate picture of one-self (one’s strengths and limitations); awareness of inner moods, intentions, motivations, temperaments, and desires; and the capacity for self-discipline and self-understanding. Individuals will be able to reflect on their own shortcomings to set useful life goals by intrapersonal intelligence [12]. It is line with Gangadevi and Ravi [10] which state that learning experience of high intrapersonal intelligence students tend to be self-confidence, independent, and discipline. Knowing self strength and weakness is an important aspect in intrapersonal intelligence. A person who knows his or her strength and weakness is able to correct mistake he or she made [6]. The intermediate intrapersonal intelligence students hurry up in completing the task, so the problem solving task inaccurate. Same idea is explained Habeeb & Fatema [11] that an individual with low intrapersonal intelligence is not able yet to do self-reflect of weakness he or she has in overcoming the problem.

Based on the previous theory above, researcher needs to conduct research related to metacognitive knowledge. The purpose of this research is to describe metacognitive knowledge of mathematics education students with high, intermediate, and low intrapersonal intelligence in analytical geometry of space.

2. Research Methods
It was qualitative research. The research was conducted at Universitas Muhammadiyah Surakarta in academic year 2018/2019 (odd semester). The selection of subjects choosen by purposive sampling. Creswell [8] explains that the purpose of selection subjects with purposive sampling is the researchers can choose individuals of research and understand the phenomenon on their focus with the detail. The selected subjects consisted of 6 students i.e. two students with high, intermediate, and low of intrapersonal intelligence. The category of high, intermediate, and low intrapersonal intelligence was obtained by questionnaire (developed by researcher) based on aspects and indicators written by Alder [2]. Other instruments for this research were interview guidelines and open start problem solving tasks on analytical geometry of space. The open start problem solving tasks given to the subjects when interview conducted as presented as follows.

Instrument for the first interview
Given points $P(0,6,4)$, $Q(0,-1,4)$, $R(−5,0,0)$, and $S$ lies on the $x$-axis. Determine the point $S$ so that $QS$ intercrosses perpendicular to $PR$, and then find the distance between $QS$ to $PR$. 


**Instrument for the second interview**
Given points $P(0,6,4)$, $Q(0,-1,4)$, $R(-5,0,0)$, and $S$ lies on the $x$-axis. Determine the point $S$ so that $QS$ intercrosses perpendicular to $PR$, and then find the distance between $PS$ to $QR$!

**Instrument for the third interview**
If determined points $A(1,2,3)$, $B(0,0,1)$, and $C(x_C,y_C,7)$ lies on a line $g_1$, than given a line $g_2$ that passes through the point $P(2,0,0)$ and perpendicular plane $V: 5x - 2y + 3z - 3 = 0$. Determine the distance point $C$ to line $g_2$!

All instruments validated by experts judgement, so it was fulfilled the criteria. The data validity for this research used time triangulation. Data retrieval with time triangulation was carried out by collecting data at different times [21]. The researcher take data twice that held at different times. The researcher would add third data retrieval, if the first data retrieval result found the difference from the second result. Data analyses were done by collecting data, reducing data, presenting data, and drawing conclusion. This research use interactive analysis for analysis model. This means that reducing data, presenting data, and drawing conclusion are reciprocal [7]. The methods of this research which described above as can be shown by Picture 1.

**Picture 1. Flowchart of the research methods**

3. **Findings**
Researcher conducted task-based interviews with the high, intermediate, and low intrapersonal intelligence subjects. Task-based interview activities were conducted to determine characteristics the metacognitive knowledge of mathematics education students in open start problem solving. The results of metacognitive knowledge description of each subject are presented as follows.

3.1. **Metacognitive Knowledge of The High Intrapersonal Intelligence Students**

a. Understanding the Problem
Subject comprehended the problem by writing statement within task using his own sentences. The subject tried to find keywords that are considered to be used in solving the problem and wrote them
down. The results of interview with the subjects when understanding the problem is shown as follows (R = The researcher; H = The high intrapersonal intelligence subjects).

| R | H |
|---|---|
| R₁: Do you understand with the given problem? | H₁: Yes I am. We ordered to calculate the distance of line QS to PR. |
| R₂: In the task, it is known that S is located at x axis and you wrote $S(a,0,0)$ on the answer sheet. What does your writing mean? | H₂: Because S is located at x axis so that y and z axis at S point are equal to zero. |

**Picture 2.** The work of subject when understanding the problem

Data H₁ show that the subject understands the problem. The subject was able to write statements of task with his or her own sentences as can be shown by Picture 2. The subject was able to give detail explanation about what were written as can be shown by Data H₂.

b. Devising a plan

Subject was devising a plan by finding correlation between known data and the problem of the task. The subject was explaining stages of the plan by connecting subject’s background knowledge with the information collected from the task. The subject was planning strategies that can be used in problem solving based on the correlation between known formulas of the task. Result of interview with subjects on devising a plan is shown as follows.

| R | H |
|---|---|
| R₃: What do you plan to solve the given problem? | H₃: The first, I want to determine the point S. |
| R₄: Why do you plan on it? | H₄: We get new information from the task that line QS intercrosses perpendicular to PR in, so it can be found the distance with point space concept to plane. |

Data H₃ indicates that the subject knows the ways taken to solve the problem. Why subject choose plan H₃ explained by data H₄.

c. Carrying out the plan

Subject was using a strategy that is considered as the most appropriate to solve the problem. The subject was able to accomplish the task correctly. It is because the subject understood the correlation between formulas well. The work of the subject in carrying out the plan can be shown by Picture 3.

**Picture 3.** The work of subject when carrying out the plan

d. Looking back

Subjects looking back task results by checking the answer. The subject decide that the answer has been correct. Results of interviews with subjects when looking back is shown as follows.

The subject was able to explain the correlation of one formula to another.
R5: Do you sure that your answer right?
H5: Yes I’m.
R6: How do you know that your answer right?
H6: I think the ways, the formulas, and the calculations were right.
R7: Does your result answer the questions?
H7: Sure, because I did it based on existing data and problem of the task.

Data H3 and H7 show that the subject self-confidence for the correctness answer. The reason subject absolutely certain for their right answer is explained by data H6.

3.2. Metacognitive Knowledge of The Intermediate Intrapersonal Intelligence Students

a. Understanding the Problem

Subject understanding the given problem by writing what is known in the task with his or her own sentences. Excerpts of interview with subjects when understanding the problem is shown as follows (R = The researcher; I = The intermediate intrapersonal intelligence subjects).

| R | I |
|---|---|
| R1: Have you understand about the problem? | I: Of coure. We ordered to calculate the distance of the QS line to PR. |
| R2: In the task, it is known that S is located at x axis and you wrote S(e,0,0) on the answer sheet. What is the meaning of your written? | I2: Because S is located at x axis, it means y and z are equal to zero. |

*Picture 4. The work of subject when understanding the problem*

I1 shows that subject understand the given problem. The subject was able to write statements of task with his or her own sentences as can be shown by Picture 4. The subject was able to give detail explanation about what were written as can be shown by Data I2.

b. Devising a plan

Subject was devising a plan by finding correlation between known data and the problem of the task. The subject was planning a solution based on the correlation between known formulas in the task. Results of excerpt interview with subjects when devising a plan is shown as follows.

| R | I |
|---|---|
| R3: How do you do to solve the given problem? | I3: I will determine point S and then make a plane that passes through PR for finding answer of the questions. |
| R4: Why do you plan it? | I4: Based on the question of the task, we know that QS crosses perpendicular to PR. |

Data I3 indicates that subject understands the procedures taken to solve the problem. The reason subject to choose plan I3 was explained by data I4.

c. Carrying out the plan

Subjects solve the problems which were appropriate with the plan. The subject using strategy that is considered as the most appropriate to solve the problem. The subject was able to finish the task. The work of the subject when carrying out the plan can be presented by Picture 5.
5. The work of subject when carrying out the plan.

d. Looking back

For this step, the subject decide that they would solve the problem correctly. Results of interview with subjects when looking back is shown as follows.

R5 : Are you sure that your answer is right?
I5 : Yes of course.

R6 : Can you explain about why do you absolutely certain that your answer is right?
I6 : I think that the way and the calculate process are correct.

Subject involve looking back for their work. Data I5 indicates that subject confidence that his answer is right. The reason subject sure that their answer is right explained by data I6.

3.3. Metacognitive Knowledge of The Low Intrapersonal Intelligence Students

a. Understanding the problem

Subject understanding the problem by written the known data in the task with his or her own sentences. Excerpts interview with the subjects when understanding the problem is shown as follows (R = The researcher; L = The low intrapersonal intelligence subjects).

Subject substitutes point Q to replace value of x2, y2, and z2 (the right answer is to substitute point R). It indicates that the subject was unable solving the problem based on the correlation between known formulas.

Picture 5. The work of subject when carrying out the plan

Picture 6. The work of subject when understanding the problem

R1 : Do you understood with problem?
L1 : Yes, I am. The problem that should be solved is compute the distance of PS line to QR.
R2 : In the task, it is known that S is located at x axis and you wrote S(a,0,0) on the answer sheet. What does your writing mean?
L2 : It is known that S is located at x axis, so that y and z axis are equal to zero.

Data L1 indicates that subjects understand about the given problem. The subject was able to write statements of task with his or her own sentences as can be shown by Picture 6. They were able to give explanation about what he or she wrote as can be shown by data L2.

b. Devising a plan

Subjects were unable to mention the problem solving steps. Results of interview with subjects when devising a plan is shown as follow.

R3 : What do you plans to solve the problem?
L3 : I would determine the point S then finding the distance PS to QR.
R4 : Why do you plan on it?
L4 : I think finding the distance of PS to QR, the coordinate of point S should have been known.
R5 : Do you have another plans?
L5 : No, I think the plans are enough.
Based on data L3 and L5, subjects have a plan to solve the problem, although the steps were still not correct. The reason subject to choose plan L3 is explained by data L4.

c. Carrying out the plan

Subject still not yet to solve the problem appropriately. The subjects’ task result when carrying out the plan are presented by Picture 7.

![Picture 7. The work of subject when carrying out the plan](image)

The formula used by the subjects are still not correct.

4. Discussion

The finding towards a subject with high intrapersonal intelligence indicates that the subject involves declarative knowledge, procedural knowledge, conditional knowledge, and self-knowledge in every stage of problem solving. The subject was understood the problem well. It is declared by the subject when he writes the known data with his or her own sentences accurately, knowing relations between formulas to another and where to apply them. In devising a plan, the subject was connecting their basic knowledge with information in the task, then planning a problem solving based on the known formulas relation, and they able to explain correct strategy to solve the problem. It is shown when the subject was able to plan stages, choose formulas and background knowledge which can be used in solving the problem. When carrying out the plan, the subject solve the problem based on selected strategies. It is indicated by the final result of the subject’s work which is appropriate with what subject had planned. In looking back step, the subject explained that the problem given is possible to be solved. The subject believes the correctness of his or her work after looking back the stages, formulas, and the calculation of the work.

The results of the research indicates that the high intrapersonal intelligence subjects have positive dominant character, i.e. able to do planning step appropriately and had high self-confidence that they were able to solve the problem, so their answer is correctly. This is line with [10] that the high intrapersonal intelligence students tend to be self-confidence, independent, and discipline, so they able finding the necessary key word to solve the task.

The research result towards a subject with intermediate intrapersonal intelligence indicates that the subject involved declarative knowledge, procedural knowledge, and conceptual knowledge, but he had not maximized his or her self-knowledge in every steps of problem solving. In the sequence of understanding the problem, the subject wrote known data correctly with subject’s own sentences. In devising a plan, the subject connected his or her background knowledge to information collected from the problem and planned problem solving based on the connections between known formulas. It can
be shown with the subject was able to plan stages based on information collected from the task. In carrying out the plan, the subject had not able to conduct problem solving based on owned procedural knowledge. It can be shown with had not maximum in correlating formula to each other. The subject feels confident about the truth of the results of his work, although the answer can be guaranteed as the correct one. In the looking back step, the subject explained that the problem is able to be solved; however the formulas and calculation result are not correct so that the final answer is inaccurate.

The results above indicate that subjects with intermediate intrapersonal intelligence had high self-assessment that they were able to solve the problem but they had not maximized when completing the task, so the result inaccurate. It show that the intermediate intrapersonal intelligence subjects had not maximized and minimized their strength weakness, so they unable to carrying out the plan properly.

Knowing the strength and weakness are an important aspects of one’s intrapersonal intelligence. It is because individuals can correct the mistake by knowing their strength and weakness [6]. In line with [6], Perez & Ruz [18] explain that intrapersonal intelligence is self-awareness involves dept knowledge of one’s self to develop the problem-solving strategies based on their weakness.

Result of research towards a subject with low intrapersonal intelligence indicates that the subject that involved declarative and procedural knowledge, was unable to maximize the conditional knowledge, and was unable to involve self-knowledge in solving the problem. In understanding the problem, the subject was able to write down the known data with his or her own sentences correctly. In devising a plan, the subject connected his or her background knowledge to information collected from the problem and planned problem solving based on the collected information. The subject was able to plan stages in problem solving, however the subject was unable to mention the details of the plan and the reasons why the subject decided to choose the plan. In carrying out the plan, subject still not yet to solve the problem appropriately. Subjects involve looking back when solve the problem. Subjects had high confidence that his answer is correct, although the truth fact of the answer was wrong.

The research result indicates that low intrapersonal intelligence subjects had high self-assessment that their answer is correct, but he can not explain steps for their problem solving because they not yet introspection and had not fix the shortcomings that are owned, so their task results inaccurate. It is because students with low intrapersonal intelligence unable yet to do self-reflect of weakness he or she has in overcoming the problem [11].

5. Conclusion
The high intrapersonal intelligence subjects have positive dominant character, i.e. able to do planning step appropriately and had high self-confidence that they were able to solve the problem, so their answer is correctly. The intermediate intrapersonal intelligence subjects had high self-assessment but they unable to carrying out the plan properly, so that it resulted inaccurate. The low intrapersonal intelligence subjects absolutely sure that their answer is correct, but he can not explain for their problem solving steps because they not yet introspection and had not fix the shortcomings that are owned, so their task results inaccurate.

Open Problem
Metacognitive knowledge was related to one’s reflective thinking ability. How is the relationship between metacognitive knowledge and one’s reflective thinking abilities?

Acknowledgement
We thank all parties for supporting this research activity. Our gratitude goes to the Directorate of Research and Community Service of the Directorate General for Research and Development of the Ministry of Research, Technology and Higher Education for Research and Development of the Ministry of Research, Technology and Higher Education which has assisted in funding the cost of multi-year research through the Graduate Research Grant Grants. We also thanks to the Director of the Graduate School and the Head of Universitas Muhammadiyah Surakarta Research Institute and its staff, who have provided facilities and encouragement so that we can conduct research.
References

[1] Acharya B R 2017 Factors Affecting Difficulties in Learning Mathematics by Mathematics Learners *International Journal of Elementary Education* 6 8-15

[2] Alder H 2001 *Boost your intelligence* (Jakarta: Erlangga)

[3] Anderson L W & Krathwohl D R 2001 *A Taxonomy for Learning, Teaching, and Assessing: A revision of Bloom’s Taxonomy of educational objectives* (New York, NY: Longman)

[4] Anggo M 2011 Pelibatan Metakoognisi dalam Pemecahan Masalah Matematika *Edumatica* 1 25-32

[5] Armstrong T 2009 *Multiple Intelligences in the Classroom* (USA: Alexandria)

[6] Azid N H & Yaacob A 2016 Enriching Orphans’ Potentials through Interpersonal and Intrapersonal Intelligence Enrichment Activities *International Journal of Instruction* 9 17-32

[7] Budiyono 2017 *Pengantar Metodologi Penelitian Pendidikan* (Surakarta: UNS Press)

[8] Creswell J W 2012 *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (Upper Saddle River: Pearson)

[9] Flavell J H 1979 Metacognition and Cognitive Monitoring: A new Area of Cognitive E-Developmental Inquiry *American Psychologcical* 31 906-911

[10] Gangadevi S & Ravi 2014 Multiple Intelligence Based Curriculum to Enhance Inclusive Education to Bring Out Human Potential *International Journal of Advanced Research* 2 619-626

[11] Habeeb K T & Fatema M 2016 Affect of Intrapersonal and Interpersonal Awareness Dimensions of Emotional Intelligence on Stress Management of Adolescents *International Journal of Applied Research* 2 589-592

[12] Hoer T R Bogeman S & Wallach C 2010 *Celebrating Every Learner* (San Francisco: Jossey Bass)

[13] Jacob J E & Paris S G 1987 Children’s Metacognition About Reading: Issues in Definition, Measurement, and Instruction *Educational Psychologist* 22 255-278

[14] Jaleel S & P Premachandran 2016 A Study on the Metacognitive Awareness of Secondary School Students *Universal Journal of Educational Research* 4 165-172

[15] Kuzle A 2013 Patterns of Metacognitive Behavior during Mathematics Problem Solving in a Dynamic Geometry Environmetn *International Electronic Journal of Mathematics Education* 8 20-40

[16] Monaghan J Pool P Roper T & Threlfall J 2009 Open-Start Mathematics Problems: An Approach to Assessing Problem Solving *Oxford University Press on behalf of The Institute of Mathematics and Its Application* 28 21-31

[17] Panchu P Bahuleyan B K Seethalakshmi & Thomas T 2016 Metacognitive Knowledge: A Tool for Academic Sucess *International Journal of Medical Research Professionals* 2 131-134

[18] Perez M M P & Ruz N R 2014 Intrapersonal Intelligence and Motivation in Foreign Language Learning *European Scientific Journal* 10 142-150

[19] Polya G 1973 *How to Solve It* (Princeton: New Jersey)

[20] Radmehr F & Drake M 2017 Exploring Students’ Mathematical Performance, Metacognitive Experiences and Skills in Relation to Fundamental Theorem of Calculus *International Journal of Mathematical Education in Science and Technology*, doi: 10.1080/0020739X.2017.1305129

[21] Satori D & Komariah A 2013 *Metode Penelitian Kualitatif* (Bandung: Alfabeta)

[22] Telaumbanua Y N Sinaga B Mukhtar & Surya E 2017 Development of Mathematics Module Based on Metacognitive Strategy in Improving Students’ Mathematical Problem Solving Ability at High School *Journal of Educational and Practice* 8 73-80

[23] Wismath S L 2015 Collaborative Learning in Problem Solving: A Case Study in Metacognitive Learning *The Canadian Journal for the Scholarship of Teaching and Learning* 6 1-17