

Judul Artikel: Identification of student's metacognition level in solving modeling mathematical problem

Terbit di: Journal of Physics: Conference Series, Vol. 1320 [Proceedings of the 2nd International Seminar on Innovation in Mathematics and Mathematics Education (ISIMMED 2018)]

	Halaman
Screen Capture Prosiding di Database Scopus	1
Screen Capture Prosiding di Scimago Journal & Country Rank (SJR)	2
Sampul Prosiding	4
Panitia Pelaksana dan Pengarah	7
Daftar Isi Prosiding	8
File Artikel (Fulltext)	1-8



Source details

Journal of Physics: Conference Series

Scopus coverage years: from 2005 to 2019

Publisher: Institute of Physics Publishing

ISSN: 1742-6588 E-ISSN: 1742-6596

Subject area: Physics and Astronomy: General Physics and Astronomy

CiteScore 2018

0.51

SJR 2018

0.221

SNIP 2018

0.454

[View all documents >](#)

[Set document alert](#)

[Save to source list](#) [Journal Homepage](#)

[CiteScore](#) [CiteScore rank & trend](#) [CiteScore presets](#) [Scopus content coverage](#)

CiteScore 2018

Calculated using data from 30 April, 2019

CiteScore rank ⓘ

$$0.51 = \frac{\text{Citation Count 2018}}{\text{Documents 2015 - 2017}^*} = \frac{11,243 \text{ Citations} >}{21,896 \text{ Documents} >}$$

*CiteScore includes all available document types

[View CiteScore methodology >](#) [CiteScore FAQ >](#)

Category	Rank	Percentile
Physics and Astronomy	#167/216	
General Physics and Astronomy		

CiteScoreTracker 2019 ⓘ

Last updated on 06 February, 2020
Updated monthly

[View CiteScore trends >](#)

[Add CiteScore to your site](#)

$$0.56 = \frac{\text{Citation Count 2019}}{\text{Documents 2016 - 2018}} = \frac{17,309 \text{ Citations to date} >}{31,134 \text{ Documents to date} >}$$

Metrics displaying this icon are compiled according to Snowball Metrics ↗, a collaboration between industry and academia.

About Scopus

- [What is Scopus](#)
- [Content coverage](#)
- [Scopus blog](#)
- [Scopus API](#)
- [Privacy matters](#)

Language

- [日本語に切り替える](#)
- [切换到简体中文](#)
- [切换到繁體中文](#)
- [Русский язык](#)

Customer Service

- [Help](#)
- [Contact us](#)

ELSEVIER

[Terms and conditions](#) ↗ [Privacy policy](#) ↗

Copyright © Elsevier B.V. ↗. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies.





SJR

Scimago Journal & Country Rank

Enter Journal Title, ISSN or Publisher Name

[Home](#)

[Journal Rankings](#)




[Country Rankings](#)

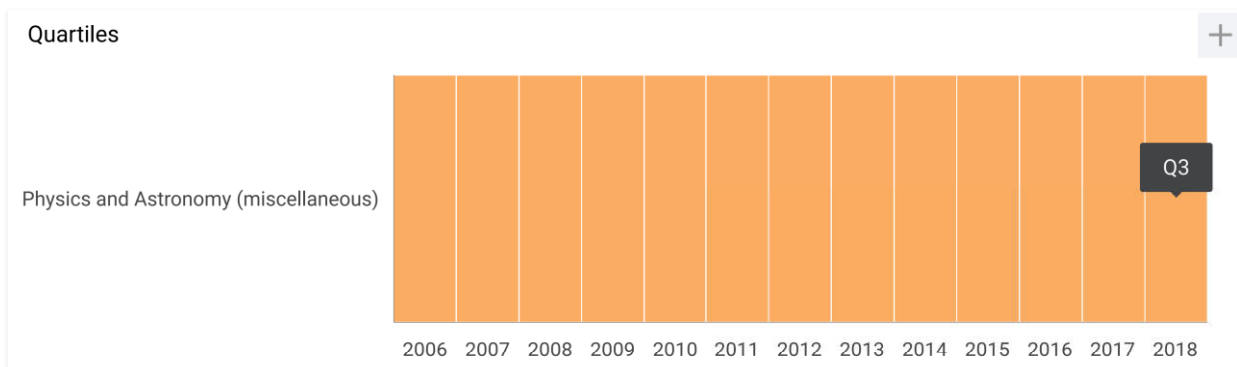
[Viz Tools](#)

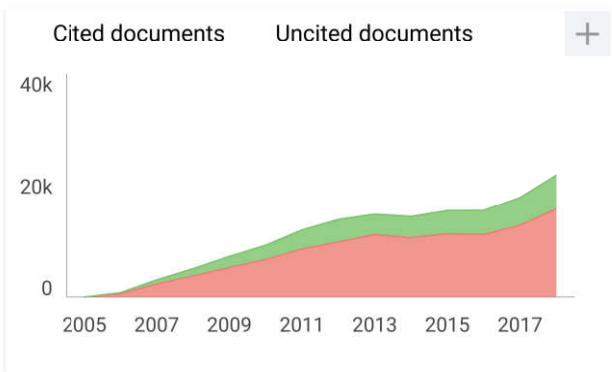
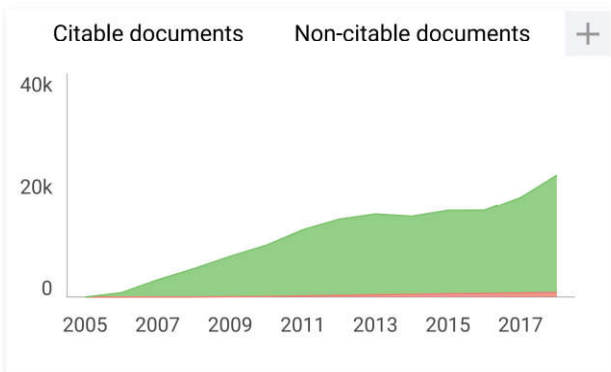
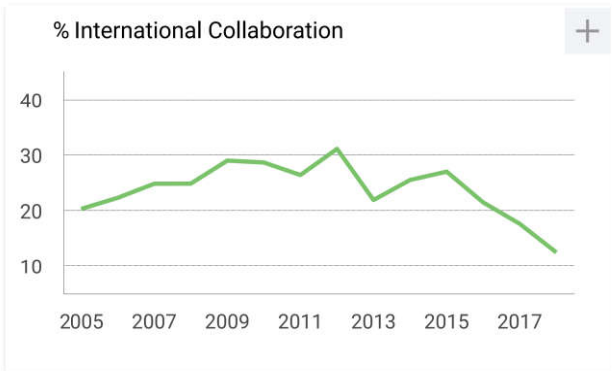
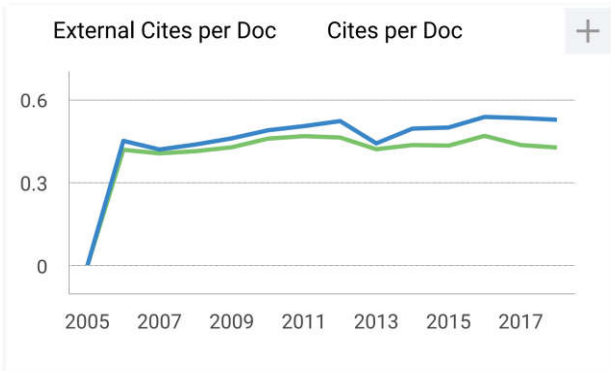
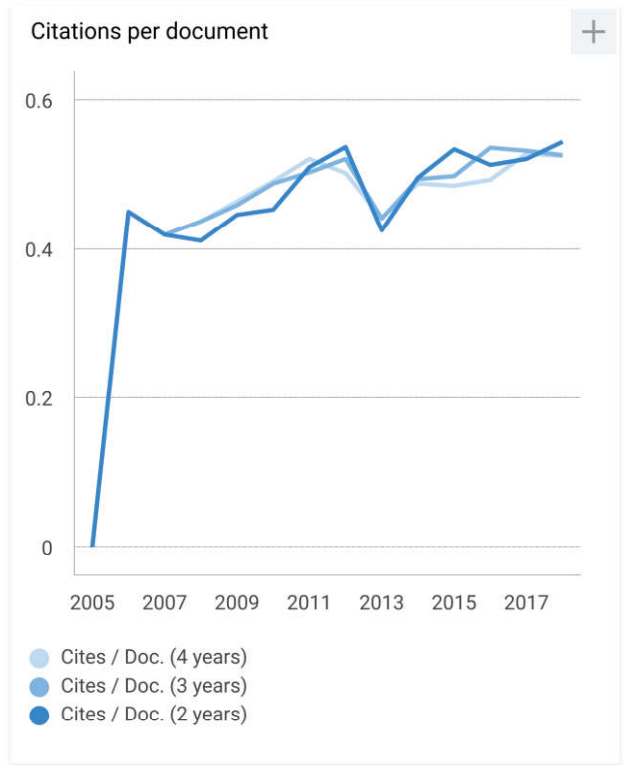
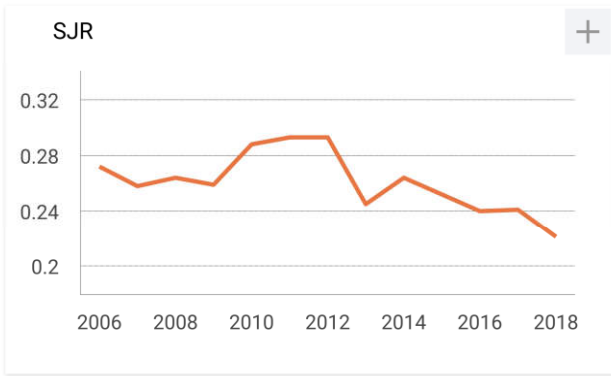
[Help](#)

[About Us](#)

Journal of Physics: Conference Series

Country	United Kingdom -  SJR Ranking of United Kingdom	<h1>65</h1> <p>H Index</p>
Subject Area and Category	Physics and Astronomy Physics and Astronomy (miscellaneous)	
Publisher	Institute of Physics	
Publication type	Journals	
ISSN	17426588, 17426596	
Coverage	2005-ongoing	
Scope	The open access Journal of Physics: Conference Series (JPCS) provides a fast, versatile and cost-effective proceedings publication service.	
	 Homepage	
	How to publish in this journal	
	Contact	
	 Join the conversation about this journal	





Journal of Physics: Conference Series

← Show this widget in your own website

Q3 Physics and Astronomy (miscellaneous) best quartile

SJR 2018 0.22

powered by scimagojr.com

Just copy the code below and paste within your html code:

```
<a href="https://www.scimagojr.com" style="color: #e67e22; text-decoration: none;">

```

PAPER • OPEN ACCESS

The 2nd International Seminar on Innovation in Mathematics and Mathematics Education (ISIMMED 2018)

To cite this article: 2019 *J. Phys.: Conf. Ser.* **1320** 011001

View the [article online](#) for updates and enhancements.



IOP | ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the collection - download the first chapter of every title for free.

**The 2nd International Seminar on Innovation
in Mathematics and Mathematics Education (ISIMMED 2018)**

Universitas Negeri Yogyakarta, Indonesia

20-24 November 2018

Editors:

Dr. Agus Maman Abadi

Fakultas Matematika dan Ilmu Pengetahuan Alam,
Universitas Negeri Yogyakarta, Indonesia
agusmaman@uny.ac.id

Dr. Ariyadi Wijaya

Fakultas Matematika dan Ilmu Pengetahuan Alam,
Universitas Negeri Yogyakarta, Indonesia
a.wijaya@uny.ac.id

José Antonio Vallejo, Ph. D.

Facultad de Ciencias,
Universidad Autónoma de San Luis Potosí, Mexico
jvallejo@fc.uaslp.mx



Preface: Proceedings of the 2nd International Seminar on Innovation in Mathematics and Mathematics Education 2018

A Wijaya¹, A M Abadi¹, and J A Vallejo²

¹Mathematics Education Department, Yogyakarta State University, Indonesia

²Facultad de Ciencias, Universidad Autónoma de San Luis Potosí, Mexico

We are honored to present a collection of articles from the 2nd International Seminar on Innovation in Mathematics and Mathematics Education (ISIMMED 2018) which was conducted in Universitas Negeri Yogyakarta, Indonesia from 20 to 24 November 2018.

The theme of the conference was '*innovative technology in mathematics: new ways for learning, teaching, and researching mathematics*'. In the era of Industrial Revolution 4.0, the use and integration of technology into various aspects of everyday life is rapidly increasing. The availability and development of advanced technology have a great impact on the practices of educational research and classroom activities in the fields of mathematics and mathematics education. This situation becomes a great challenge and motivation for researchers and educators. Various technological innovations have been invented and developed to improve the quality of research and education in the field of mathematics. The advanced technological tools such as computer algebra systems (CAS), interactive and dynamic geometry software, and hand-held devices, have been enabling the effectiveness of mathematics teaching and learning.

During the ISIMMED 2018, scholars, educators, and researchers in the field of mathematics and mathematics education from many countries gathered to share their expertise and works. After a series of review process, 108 articles are selected to be published in this Scopus-indexed proceeding. The remaining articles are published in the regular proceeding.

The editors and the committees of ISIMMED 2018 would to thank the participants who have contributed and shared their scientific works in this proceeding. We also would to to express our gratitude to every committee member for organizing the conference and to Universitas Negeri Yogyakarta for the financial support.

15 March 2019

Editors

Ariyadi WIJAYA

Agus Maman ABADI

José Antonio VALLEJO

List of Committees

International Program Committee (IPC)

International Program Co-Chairs

Wei-Chi YANG , Radford University, U.S.A.

Weng Kin HO , NIE/ Nanyang Technological University, Singapore

International Program Committee

Paul ABBOTT , University of Western Australia, Australia

Tilak de ALWIS , Southeastern Louisiana University, U.S.A.

Keng Cheng ANG , NIE/ Nanyang Technological University, Singapore

Yiming CAO Beijing Normal University, China

Jen-Chung CHUAN , National Tsing Hua University, Taiwan

Jean-Jacques DAHAN , Paul Sabatier University Toulouse France

Ma. Louise Antonette De Las Penas , Ateneo De Manila University, Philippines

Hongguang FU , University of Electronic Science and Technology-Chengdu (UESTC), China

Masami ISODA , University of Tsukuba, Japan

Matthias KAWSKI , Arizona State University, U.S.A.

Mirosław MAJEWSKI , New York Institute of Technology, United Arab Emirates

Krongthong KHAIRIREE , Suan Sunandha Rajabhat University, Thailand

Barry KISSANE , Murdoch University, Australia

Carl LIU , Leshan Vocational and Technical College, China

Alasdair McANDREW , Victoria University, Australia

Douglas MEADE , The University of South Carolina, U.S.A.

Eva Milková , University of Hradec Králové, Czech Republic

Vladimir Nodelman , Holon Institute of Technology, Israel

Inder K RANA , Indian Institute of Technology, Powai, India

Tadashi TAKAHASHI , Konan University, Japan

José Antonio VALLEJO , Universidad Autónoma de San Luis Potosí Mexico

Tianfei WANG, Leshan Normal University, China

Yuan YUAN , Chung Yuan Christian University, Taiwan

Local Organizing Committee (LOC)

Dr. Hartono

Dr. Ali Mahmudi

Dr. Ariyadi Wijaya

Dr. Sri Andayani

Dr. Agus Maman Abadi

Dr. Sugiman

Prof. Dr.rer.nat. Widodo, M.S.

Dr. Wahyudi Wahyudi

Endah Retnowati, PhD.

Wahyu Setyaningrum, PhD.

Kismiantini, PhD.

Sahid, MSc.

Advisory Committee

Bruno BUCHBERGER, LINZ, Austria

Peng Yee LEE, NIE/ Nanyang Technological University, Singapore

Lu YANG, Chinese Academy of Sciences, China

Table of contents

Volume 1320

2019

◀ Previous issue Next issue ▶

The 2nd International Seminar on Innovation in Mathematics and Mathematics Education (ISIMMED 2018)
20–24 November 2018, Yogyakarta, Indonesia

[View all abstracts](#)

Accepted papers received: 27 August 2019

Published online: 29 November 2019

Preface

OPEN ACCESS 011001
The 2nd International Seminar on Innovation in Mathematics and Mathematics Education (ISIMMED 2018)
+ [View abstract](#) [View article](#) [PDF](#)

OPEN ACCESS 011002
Peer review statement
+ [View abstract](#) [View article](#) [PDF](#)

Papers

OPEN ACCESS 012001
A model of predator-prey differential equation with time delay
H 'Arifah and K P Krisnawan
+ [View abstract](#) [View article](#) [PDF](#)

OPEN ACCESS 012002
Hopf bifurcation of actuated micro-beam nonlinear vibrations in micro electro mechanical systems
K P Krisnawan
+ [View abstract](#) [View article](#) [PDF](#)

OPEN ACCESS	012089
Self-regulated learning in blended learning approach	
W Setyaningrum	
+ View abstract View article PDF	
OPEN ACCESS	012090
Modules and their endomorphism rings	
H Susanto, S Irawati, I N Hidayah and Irawati	
+ View abstract View article PDF	
OPEN ACCESS	012091
Expanding hypothetical learning trajectory in mathematics instructional	
Charina Ulfa and Ariyadi Wijaya	
+ View abstract View article PDF	
OPEN ACCESS	012092
Ethnomathematics: humanistic learning to manage math anxiety	
Darwis Cahyo Nugroho and Djamilah Bondan Widjajanti	
+ View abstract View article PDF	
OPEN ACCESS	012093
Identification of student's metacognition level in solving modeling mathematical problem	
Dewi Thufaila and Sugiman	
+ View abstract View article PDF	
OPEN ACCESS	012094
Problem solving is about making connections	
D Nugroho and R H Santoso	
+ View abstract View article PDF	
OPEN ACCESS	012095
The effectiveness of contextual learning in the cooperative learning of think pair share based on mathematics concept understanding of the 7 th grade junior high school	
Diana Prastiwi, Sugiman and Endang Listyani	
+ View abstract View article PDF	
OPEN ACCESS	012096
Making mathematics classes more humanistic	
D B Widjajanti	
+ View abstract View article PDF	

PAPER • OPEN ACCESS

Identification of student's metacognition level in solving modeling mathematical problem

To cite this article: Dewi Thufaila and Sugiman 2019 *J. Phys.: Conf. Ser.* **1320** 012093

View the [article online](#) for updates and enhancements.



IOP | ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the collection - download the first chapter of every title for free.

Identification of student's metacognition level in solving modeling mathematical problem

Dewi Thufaila¹, Sugiman²

^{1,2}Graduate School, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

¹dewithufaila3@gmail.com, ²sugiman@uny.ac.id

Abstract. This study aims at identifying the students' metacognition level in solving mathematical modeling problem. Subjects of this study is eight seventh grade students in junior high school which selected based on their latest mathematics test exam score and communication ability test. The results of this study are obtained by using mathematical modeling problem test and interview. The results of this study are that students in the tacit use level is not know the reason why did they use the certain ways that they did to solve the problem, most of the time they just use 'try and error' method. Students in the aware use already know the reason why they use a certain ways to solve a certain problem. Students in the strategic use are capable on create their own strategy before solving the problem. Students in reflective use are not only building a plan before solving the problem, but also reflecting and evaluating during and after they obtain the result of the problem.

1. Introduction

Metacognition is defined as knowledge about, awareness of, consideration, and control over one's cognitive processes, strategies and its results; an ability to monitor and manage one's cognitive processes, strategies and its results; as well as evaluate and regulate one's cognitive processes, strategies and its results. In other words, the metacognition can be categorized into some components, namely components related to the knowledge or self-awareness and components related to monitoring and evaluation of the thinking process and its result [1]–[3].

Metacognition is the ability to be aware and be able to control one's cognitive process and strategies which are highly important in the learning and problem solving process. Metacognition is an understanding about their ability, strategy, resources needed to complete a task that included: finding the main idea, training informations, create associations or a big picture, using technique to do cognitive tasks, using tests to confirm doubts [4]. Metacognition have a big part of controlling one's cognitive in learning process in order to think and solve problem a lot more effective and efficient. However, every pupil has different ways and ability to perceive a problem. Some pupils might be consciously aware of the given problem and solving it hierarchical while other pupils might solve it recklessly and completely unaware of the essence of the problem. This type of understanding is due to students' different level of awareness or different level of metacognitive [5]. Perkins [6] categorize students' metacognition level into four different categories. The first category is tacit use level. In tacit use level, learners are making decision without thinking through it. Learners are unaware of their cognition process. Learners are only using "try and error" method where one uses randoms mathematical formulas without using any cognitive strategy to solve the problem. The second in the



category is aware use. In this level of thinking, learners are starting to be aware of their own thinking. Learners are starting to understand about what strategy and knowledge has to be used in a certain situation. The third level is strategic use which in this level of thinking, learners are capable of organizing their thought and aware of some certain strategies that can be used to help overcome a certain situation. The fourth one on the list is reflective use. In this level of thinking, learners not only aware and using cognitive strategies to help them to do some problem solving activities easier, but they also capable to reflect upon their strategies that they had used before in order to improve or fix just in case some mistakes are found and to evaluate the result of their own work in order to get the best mistake free result.

Metacognition is the ability to be aware and be able to control one's cognitive process and strategies which are highly important in the learning and problem solving process. Metacognitive have a big part of controlling one's cognitive in learning process in order to think and solve problem a lot more effective and efficient. When the way of thinking and solving problem become a lot more efficient, more effective, and easier, the ability to think and to solve problem will grow. Therefore, metacognition is very beneficial to increase one's ability to learn and solve problem. Along with the ability to think and solve problem increasing, the learning achievement is too will be increasing. Therefore one's level of metacognition is equal with one's learning achievement. The study conducted by Agustina and Trineke [7] about metacognition level in solving mathematical problem about circumference of square and rectangle concluded that students' who gain high score in solving the problem belong in strategic use level of metacognitive, while the moderate and lower score belong in aware use and tacit use consecutively. Unfortunately the study had not been able to find a student categorized in reflective use level. Another study conducted by Panaoura and Philippou [8] about the measurement of young pupils' metacognitive ability in mathematics concluded that students that have high ability in knowing and organizing their cognition and aware of their own cognitive capability showing more capability in thinking strategically and problem solving compared to those who do not have aforementioned ability.


Mathematical modeling problems is a mathematical problem which contain a real life mathematical problem by which the learners cannot directly solving the problem using mathematical formulas, but has to go through certain chain in activities in which starting from the learners translate said real life problem to a situation model which then structured and simplified into a real model and thereupon transformed to a mathematical model which activities called 'mathematizing'. The problem then solved using the suitable mathematical formulas to solve the problem by then the results are generated into a certain context of the initial problem. The chain of activities then run by several times until the desired results are obtained [9], the process is called mathematical modeling. Mathematical modeling is a process to build a model based on an applied mathematics problem and using it to solve the problem [10].

Real life problem is the most common problem that is going to be faced by every human being all their lives. Therefore it is important to understand the most effective, efficient, and easiest way to solve it. Considering that metacognition offer more effective, efficient, and easier way to solve mathematical problems, it is important to understand how metacognition would play a role in solving a mathematical modeling problem. Thus based on previous references, a study entitled "Identification of Student's Metacognition Level in Solving Modeling Mathematical Problem" is carried out.

2. Research Methodology

This study is a descriptive explorative that aims to describe students' metacognition level in solving mathematical modeling problem. The subject in this study is eight seventh grade students in the academic year of 2018/2019. Subjects are chosen based on their ability to communicate their thoughts which obtained by a conducted communication ability test beforehand and their mathematics ability which obtained by the latest mathematics exam's result conducted by teacher. Based on the test results then the students are divided into four groups of students in high, upper moderate, lower moderate, and low. Then, from each category, two students are chosen to the subject of the study. Aside from the

researcher as the main instrument, there are three other auxiliary instrument, namely communication ability test, two mathematical modeling problems that was given one by one and each problem was given by a distinct period of time, and interview guideline.

<p>Perhatikan gambar di bawah ini. Diketahui terdapat 3 ukuran botol yaitu botol besar, botol sedang, botol kecil dan gelas. Banyak air yang dapat dituangkan seperti pada gambar di bawah ini</p>  <p>Berapa banyak gelas air yang kamu tuangkan ke dalam botol besar?</p>	<p>Figure 1. Mathematical Modeling Problem: “Pay attention to the pictures below. Known that there are 3 sizes of bottles, big bottles, medium bottles, and small bottles, and glasses. The amounts of water that can be contained explained in the pictures below. Hoe many glasses that you should pour to fill a big bottle?”</p>
---	---

3. Findings

From the study conducted, each subject shows different metacognition activities. Written below are the metacognition activities from each subject in each metacognition level. The first elaboration is the result came from students in tacit use level. There were two students that put in the tacit use level of metacognitive based on their latest mathematics exam score which are two of the lowest score in class. Both students had to read the problem repeatedly and took them a quite long time to understand the given problem. They tried to solve the problem with a certain ways that they didn't even understand the reason why they did it. They mostly just used “try and error method”, they tried to solve it with random mathematical formulas, like adding and multiplying without understanding the problem and the needs of the problem real well. It is relevant with Gregory [11] that stated that subjects in the metacognition level of tacit use made a decision without thinking about those decision beforehand. This result also relevant with a study conducted by Lauren [3] which concluded that the subjects in the level of tacit use had something called instrumental understanding, it is an understanding of using a way without knowing or realizing the reason behind it. After they got an answer to the problem, they got so confident that they didn't feel the need to check twice to know

whether their answer was the correct answer. By the way they acted while solving the problem; it looked like they tried to solve the problem in hurry and tried to finish the work as soon as possible.

<p>1 Botol kecil = 2 gelas air 1 Botol sedang = 4 gelas air 1 Botol Besar = 16 gelas air</p>	<p>Figure 2. Subject 8: "1 little bottle equals 2 glasses of water; 1 medium bottle equals 4 glasses of water; 1 big bottle equals 16 glasses of water."</p>
<p>4 botol sedang = 1 botol besar 2 botol kecil = 1 botol sedang 6 gelas = 1 botol kecil dan satu botol sedang Jika 1 botol kecil menghasilkan 2 gelas dan 1 botol sedang menghasilkan 4 gelas. Berapa gelas untuk botol besar? 4 botol sedang = 16 gelas (4x4) Jadi 1 botol besar menghasilkan 16 gelas.</p>	<p>Figure 3. Subject 7: "4 medium bottles equal 1 big bottle; 2 little bottles equal 1 medium bottle; 6 glasses equal 1 little bottle and 1 medium bottle; If 1 little bottle produces 2 glasses and 1 medium bottle produces 4 glasses; How many glasses does it take for big bottle?; 4 medium bottles equal 16 glasses; 4 times 4; So, 1 big bottle produces 16 glasses."</p>

The second level is aware use. There were two students that put in the aware use level of metacognitive based on their latest mathematics exam score which are two of the lower-moderate score in class. Both students had to read the problem repeatedly to understand the given problem. Students in the aware use level of metacognitive capable of explaining the reason why they did a certain mathematical process to solve the problem after they got the answer, but found it hard to planned it beforehand. This result is relevant with a study conducted by Danang [12] who stated that the subject in this level was eliciting the reason and the steps of the thinking that was used, the story behind the made decision, and the awareness of the weakness. By the way the acted while they solve the problem, it looked like they found the way to solve the problem as they go. After they got the answer, they felt very confident on their work and didn't feel the need to check the correctness after.

<p>1. 4 botol sedang = 1 botol besar 2 botol kecil = 1 botol sedang 2 gelas = 1 botol kecil 4 gelas = 1 botol sedang</p> <hr/> <p>4 gelas mengisi 1 botol sedang 4 botol sedang mengisi 1 botol besar</p> <p>= 4 gelas x 4 botol sedang = 4 x 4 = 16 gelas</p>	<p>Figure 4. Subject 6: "4 medium bottles equal 1 big bottles; 2 little bottles equal 1 medium bottles; 2 glasses equal 1 little bottle; 4 glasses equal 1 medium bottle; 4 glasses fill up 1 medium bottle; 4 medium bottles fill up 1 big bottle; equals 4 glasses times 4 medium bottles; equals 4 times 4 equals 16 glasses."</p>
---	--

1 Botol besar = 4 botol sedang
 1 Botol sedang = 2 botol kecil dan 6 gelas
 1 Botol kecil = 6 gelas
 6 (Gelas) x 3 = 18 gelas
 (1 botol kecil dan 1 botol sedang)
 1 Botol besar dibagi sama botol sedang sama rata
 1 Botol sedang dibagi 2 botol kecil sama rata
 1 Botol kecil dibagi 6 gelas sama rata
~~18 : 6 = 3~~
 18 : karena untuk mengisi besar sama rata
 6 = Hasil dari 6 gelas
 3 = Hasil dari pembagian gelas tambah botol kecil dan tambah botol sedang

Figure 5. Subject 5: “First method : 1 big bottle equals 4 medium bottles; 1 medium bottle equals 2 little bottles; 1 little bottle equals 6 glasses; 6 (glasses) times 3 equals 18 glasses; and 1 medium bottle; If 1 little bottle produces 2 glasses and 1 medium bottle produces 4 glasses, then how many glasses does it take to fill 1 big bottle?; 4 medium bottles equal 16 glasses; 4 times 4; So, 1 big bottle produces 16 glasses.”

Third on the list is strategic use level of metacognitive. There were two students that put in the strategic use level of metacognitive based on their latest mathematics exam score which are two of the upper- moderate score in class. Both students had to read the problem repeatedly to understand the given problem. Before they solved the problem, researcher asked all subjects to create a plan to solve the problem, what they should do after they understand the problem until they find the final answer. Both students in strategic use level of metacognitive were capable of created and explained more than one way to solve the problem, and then chose the simplest way to find the solution. It is similar with a result concluded by Danang [12] that subjects in this metacognition level started to realizing their skill and capability and capable of defending their thoughts, knowing how to convince. Although the subject in this study showing a little different result with Danang’s subjects [12] where their subjects did some recalculating, revising, rechecking, and comparing the answer to the initial problem where subjects in this study still didn’t feel the need to check their final answer when researcher asked them to.

1 Botol sedang = 2 botol kecil
 6 gelas = 1 Botol kecil dan 1 Botol sedang ^{di Sebelah} ~~di bawah~~ menjadi 2 Botol kecil
 1 Botol besar = 8 Botol kecil
 8 Botol kecil = 16 gelas
 Perlu 8 Botol kecil = 12 gelas
 1 Botol kecil = 2 gelas
 : banyak gelas air yang kamu tuangkan ke dalam botol besar adalah 16 gelas

Figure 6. Subject 3: “1 medium bottle equals 2 little bottles; 6 glasses equal 1 little bottle and 1 medium bottle which being equalized to 2 little bottles; 1 big bottle equal 8 little bottles; 8 little bottles equal 16 glasses; need 6 little bottles equal 12 glasses; 1 little bottles equal 2 glasses; the amount of water glasses that you pour into the big bottles is 16 glasses.”

<p>6 gelas = 1 botol sedang dan 1 botol kecil = 6 gelas + 2 botol kecil = 1 botol sedang 4 botol sedang = 1 botol besar Dit : Berapa banyak gelas air yg dituangkan ke botol besar Cara : 6 gelas + 2 botol ^{kecil} sedang sama dengan 1 botol sedang 1 botol sedang digandeng jadi 2 botol kecil 3 botol kecil = 6 gelas 1 botol kecil = 2 gelas</p>	<p>Figure 7. Subject 3: “6 glasses equal medium bottles and little bottle; 2 little bottles equal 1 medium bottle; 4 medium bottles equal 1 big bottle; Asked : how many glasses of water are poured into the big bottle?; Steps : 2 little bottles equal 1 medium bottle; 1 medium bottle changed into 2 little bottles; 3 little bottles equal 6 glasses; 1 little bottle equals 2 glasses.”</p>
---	---

The last one is the highest level of metacognitive named reflective use. There were two students that put in the reflective use level of metacognitive based on their latest mathematics exam score which are two of the highest score in class. Both students had to read the problem repeatedly to understand the given problem. When asked, both students in strategic use level of metacognitive were capable of created and explained more than one way to solve the problem, and then chose the simplest way to find the solution. Both subjects were highly elaborate and checked the initial problem repeatedly while they did the problem solving activity to make sure that they did the correct way to solve the problem. It is similar with the result of a study conducted by Lauren [3] where the subjects doing a reconsideration and check for compatibility to the initial problem after a solution had been found. After they found the final answer and asked whether they need to check their answer again, they accepted the offer and meticulously checked it again. They gave the correct answer to the problem but didn't look as confident as the other subjects in other levels. They were highly elaborate in solving the problem and took their time doing it while keep checking their steps repeatedly as they went, and keep checking it even after they got the final answer. This result is relevant with a study conducted by Danang [12] who concluded that the subjects in this level of metacognitive reflect their thinking constantly from the moment they saw the problem, while doing the problem, and after they got the answer.

<p>1 botol sedang = 2 botol kecil 1 botol botol kecil + 1 botol sedang = 3 botol kecil 3 botol kecil = 6 gelas 1 botol kecil = 2 gelas 4 gelas = 1 botol sedang 4 gelas x 4 botol sedang = 16 gelas = 1 botol besar</p>	<p>Figure 8. Subject 1: “1 medium bottle equals 2 little bottles; 1 little bottle added by 1 medium bottle equals 3 little bottles; 3 little bottles equal 6 glasses; 1 little bottle equals 2 glasses; 4 glasses equal 1 medium bottle; 4 glasses times 4 medium bottles equal 16 glasses equal 1 big bottle”</p>
---	---

<p>1.) Memahami dan mencermati soal yg akan dijawab 2.) Mengingat kembali yang diketahui di soal tersebut 3.) Menjawab soal yg sudah kita ketahui dengan teliti</p> <p>Diketahui : 4 botol Sedang = 1 botol besar 2 - 11 - kecil = 1 botol Sedang 6 gelas = 1 - 11 - kecil dan 1 botol Sedang</p> <p>Ditanya : Bp banyak gelas air yg dituangkan ke botol besar?</p> <p>Jawab : 6 gelas = 1 bh dan 1 bs + 6 gelas = 2 bk dan 2 bs + 4 gelas = 16 gelas</p>	<p>Figure 9. Subject 2: “1) Understanding and carefully look at the question that are going to be solved; 2) recalling the memories related to the what’s known from the question; 3) answer the question that we already known thoroughly; Known : 4 medium bottles equal 1 big bottles; 9 little bottles equal 1 medium bottle; 6 glasses equal 1 little bottle and 1 medium bottle; Asked : How many glasses of water that are poured into the big bottle? ; Answer : 6 glasses equal 1 LB (little bottle) and 1 MB (medium bottle) added by 6 glasses equals 2 LB and 2 MB added by 4 glasses equals 16 glasses.”</p>
---	--

4. Conclusion

Based on the analysis, it resulted that students in the tacit use level is not know the reason why did they use the certain ways that they did to solve the problem, most of the time they just use ‘try and error’ method. Students in the aware use already know the reason why they use a certain ways to solve a certain problem. Students in the strategic use are capable on create their own strategy before solving the problem. Students in reflective use are not only building a plan before solving the problem, but also reflecting and evaluating during and after they obtain the result of the problem.

5. Suggestion

This study about identification of student’s metacognition level in solving modeling mathematical problem needs to be developed more. This study is an attempt to creating a connection between two interesting theme in mathematics education field namely metacognition and modeling mathematics. Although this study is only using modeling mathematics as an instrument to found out subjects’ metacognition and hardly mention about subjects’ modeling process and focusing more on subjects’ metacognition process. There should be another study conducted to engage those two interesting aforementioned theme in the future.

References

- [1] Flavell J H 1976 Metacognitive Aspects of Problem Solving *The Nature of Intelligence* (New Jersey: Lawrence Erlbaum Associates) pp. 231–236
- [2] Swartz R and Perkins D 1990 *Teaching Thinking: Issues Approaches*. California: Critical Thinking Press & Software
- [3] Laurens T 2010 Penjenjangan Metakognisi Siswa yang Valid dan Reliabilitas *J. Pendidik. Dan Pembelajaran* **17** 201–213
- [4] Chrissanti M I 2015 Keefektifan Pendekatan Metakognitif Ditinjau dari Prestasi Belajar, Kemampuan Berpikir Kritis dan Minat Belajar Matematika *J. Ris. Pendidik. Mat.* **2** 51–62
- [5] Sophianingtyas F and Sugiarto B 2013 Identification of Students ’ Metacognitive Level in Solving Stoichiometry Problem *UNESA J. Chem. Educ.* **2** 21–27

- [6] Perkins D 1992 *Smart Schools: Better Thinking and Learning for Every Child* (New York: Free Press)
- [7] Mahromah L A and Manoy J T 2013 Identifikasi Tingkat Metakognisi Siswa Dalam Memecahkan Masalah Matematika Berdasarkan Perbedaan Skor Matematika *MATHEdunesa*, **2**
- [8] Panaoura A and Philippou G 2005 The Measurement of Young Pupils' Metacognitive Ability in Mathematics: The Case of Self-Representation and Self-Evaluation [Online] Available: <https://pdfs.semanticscholar.org/f046/cd709526a7d5333a2505af8a61fa27c58e14.pdf>. [Accessed: 14-Oct-2018]
- [9] Blum W and Leiß D 2005 Filling up' – The Problem of Independence-Preserving Teacher Interventions in Lessons With Demanding Modelling Tasks in *Proceedings of the 4th European Congress of Mathematics Education* pp. 1623–1633
- [10] Greefrath G 2016 *ICME 13 TS* **10** 1007
- [11] Gregory G H 2005 *Differentiating Instruction with Style: Aligning Teacher and Learner Intelligences for Maximum Achievement* (California: Corwin Press)
- [12] Setyadi D, Subanji S, and Muksar M 2016 Identification of students' metacognition level in solving mathematics problem about sequence *IOSR J. Res. Method Educ.* **10** 9790