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The Global Challenges on The Development and
The Education of Mathematics and Science

Faculty of Mathematics and Science
Yogyakarta State University

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- Mathematics & Mathematics Education
- Physics & Physics Education
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Preface

Bless upon God Almighty such that this proceeding on 3rd International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS) may be compiled according to the schedule provided by the organizing committee. All of the articles in this proceeding are obtained by selection process by the reviewer team and have already been presented in the Conference on 16 – 17 May 2016 in the Faculty of Mathematics and Natural Sciences, Yogyakarta State University. This proceeding comprises 9 fields, that is mathematics, mathematics education, physics, physics education, chemistry, chemistry education, biology, biology education, and science education.

The theme of this 3rd ICRIEMS is '*The Global Challenges on The Development and The Education of Mathematics and Science*'. The main articles in this conference are given by six keynote speakers, which are Prof. Allen Price, Ph.D (Emmanuel College Boston USA), Ana R. Otero, Ph.D (Emmanuel College Boston USA), Dr. Michiel Doorman (Utrecht University, Netherlands), Prof. Dr. Marsigit, M.A (Yogyakarta State University), Asst. Prof. Dr. Warakorn Limbut (Prince of Songkla University, Thailand), and Prof. Dr. Rosly Jaafar (Universiti Pendidikan Sutan Idris, Malaysia). Besides the keynote and invited speakers, there are also parallel articles that presented the latest research results in the field of mathematics and sciences, and the education. These parallel session speakers come from researchers from Indonesia and abroad.

Hopefully, this proceeding may contribute in disseminating research results and studies in the field of Mathematics and Sciences and the Education such that they are accessible by many people and useful for the Nation Building.

Yogyakarta, May 2016

The Editor Team

Forewords From The Head Of Committee

Assalamu'alaikum warahmatullahi wabarakatuh

May peace and God's blessings be upon us all

First of all, allow me to thanks to God, Allah SWT, who has been giving us blessing and mercies so we can join this conference. Ladies and Gentlemen, it is my great honor to welcome you to Indonesia, a unique country which has more than 17,000 islands, more than 1,300 ethnic groups, and more than 700 local languages, and I am also very happy to welcome you to Yogyakarta, the city of education, culture, tourism, and a miniature of Indonesia. We wish you be happy and comfortable in attending the conference in this city.

The third International Conference on Research, Implementation, and Education of Mathematics and Science (ICRIEMS 3rd) 2016 is organized by the Faculty of Mathematics and Science, State University of Yogyakarta. In this year, theme of the conference is : The Global Challenges on The Development and The Education of Mathematics and Science. This conference are dedicated to the 52nd anniversary of Yogyakarta State University and to face challenges of Asean Economic Community in 2016.

This conference facilitates academics, researchers and educators to publish and disseminate their research in the fields of pure, application and education of Science and Mathematics. Furthermore, the purposes of the conference are to establish interaction, communication, and cooperation among academics, researchers and educators at an international level.

On behalf of the committee of this conference, I would like to express our highest appreciation and gratitude to the keynote speakers, including:

1. Allen Price, Ph.D. (Associate Professor of Emmanuel College, Boston USA)
2. Ana R. Otero, Ph.D. (Emmanuel College, Boston USA)
3. Dr. L.M. (Michiel) Doorman (Associate Professor of Utrecht University, Netherland)
4. Prof. Dr. Marsigit, MA. (FMIPA, Universitas Negeri Yogyakarta)
5. Asst. Prof. Dr. Warakorn Limbut (Faculty of Science, Prince of Songkla University, Thailand)
6. Prof. Dr. Rosly Jaafar (Faculty of Physics, Universiti Pendidikan Sultan Idris, Malaysia)

Furthermore, we inform you that the papers presented in this conference are about 200 papers from 302 applicants, who come from various countries and various provinces throughout Indonesia. Therefore, I would like to give my appreciation and many thanks to the presenters and participants who have been actively involved in this seminar.

Finally, I would like to thank the committee members who have been working very hard since half a year ago to ensure the success of the conference. However, if you find any shortcomings and inconveniences in this conference, please forgive us. We would very

happy to receive your suggestions for improvement in the next conference. Thank you very much.

Wassalamu'alaikum warohmatullahi wabarakatuh.

Yogyakarta, May 2016

Dr. Warsono, M.Si.

Forewords From The Dean Of Faculty Of Mathematics And Sciences, Yogyakarta State University

Assalamu'alaikum warahmatullahi wabarakatuh. My greetings for all of you. May peace and God's blessings be upon us all.

On behalf of the Organizing Committee, first of all allow me to extend my warmest greeting and welcome to the International Conference on Research, Implementation, and Education of Mathematics and Sciences, the third to be held by the Faculty of Mathematics and Science, State University of Yogyakarta, one of the excellent and qualified education universities in Indonesia. This conference is also celebrate the 52th Anniversary of State University of Yogyakarta.

This conference proudly presents keynote speeches by six excellent academics, these are: Allen Price, Ph.D., Ana R. Otero, Ph.D., Dr. Michiel Doorman, Prof. Dr. Marsigit, MA., Asst. Prof. Dr. Warakorn Limbut, and Prof. Dr. Rosly Jaafar, and around 200 regular speakers.

The advancement of a nation will be achieved if education becomes a priority and firmly supported by the development of technology. Furthermore, the development of technology could be obtained if it is supported by the improvement of basic knowledge such as mathematics, physics, chemistry, and biology. The empowerment of this fundamental knowledge may be achieved by conducting research which is then implemented in developing the technology and the learning process in schools and universities.

This international conference is aimed to gather researchers, educators, policy makers, and practitioners to share their critical thinking and research outcomes. Moreover, through this conference it is expected that we keep updated with new knowledge upon recent innovative issues and findings on the development and the education of mathematics and science, which is in accord with the theme of the conference this year. All material of the conference which are compiled in the abstract book and proceedings can be useful for our reference in the near future.

This conference will be far from success and could not be accomplished without the support from various parties. So let me extend my deepest gratitude and highest appreciation to all committee members who have done an excellent job in organizing this conference. I would also like to thank each of the participants for attending our conference and bringing with you your expertise to our gathering. Should you find any inconveniences and shortcomings, please accept our sincere apologies.

To conclude, let me wish you fruitful discussion and a very pleasant stay in Yogyakarta.

Wa'alaikumsalam warahmatullahi wabarakatuh

Yogyakarta, May 2016
Dean Faculty of Mathematics and Science
Yogyakarta State University

Dr. Hartono, M.Si.

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Integrating Maratib Qira'ah Al-Qur'an and Marzano's Taxonomy to Provides Learning Objectives in Mathematics

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Abstract: This research is a development research, which aims to develop a new taxonomy theoretically by integrating *marâtib qirâ'ah al-Qur'an* and Marzano's taxonomy. This integration produces a concept about the classification of learning objectives which more comprehensive, including the description of integration result and the indication of learning achievement in all levels of integration result. In addition, this research provides examples of its application in formulating mathematics learning objectives. The research data were obtained from the result of literature study and interviewed to the expert of Arabic and Qur'an Education. Data were analyzed as a material to formulate the draft of integration result. The drafts were discussed with the expert of Qur'an Education and the lecturer of Mathematics Education in a sustainable manner to obtain a logical and accountable result. The results shows that the integration between *marâtib qirâ'ah al-Qur'an* and Marzano's taxonomy produces 5 new levels in the classification of learning objectives. These classifications include: 1) Retrieving knowledge (Integration of *talaffuẓ* and retrieval); 2) Comprehending knowledge (Integration of *tafahhum* and comprehension); 3) Analyzing knowledge (Integration of *tadabbur* and analysis); 4) Utilizing knowledge (Integration of *tafakkur* and knowledge utilization); and 5) System of self-control (Integration of *takhassyu*', metacognitive system, and self-system).

Keywords: *marâtib qirâ'ah al-Qur'an*, *Marzano's taxonomy, and learning objectives*.

I. INTRODUCTION

Mathematics learning is a very important thing in the world of education. The importance of mathematics learning can not be separated from the role of mathematics in all aspects of life. However, the world notes that the mathematics education in Indonesia is far from perfect. It is proven from the acquisition of Indonesia in TIMSS 2011 which showed that the mathematical ability of Indonesian students is at level 36 of the 48 participant countries. That achievement was even relatively worse in PISA 2012, which puts Indonesia on the 2nd lowest rank of the 65 sample countries, ie only one rank higher than Peru. Considering the importance of mathematics, and also a variety of problems that arise in mathematics education in Indonesia, arises a question how should mathematics learning in schools be organized so that mathematics can be mastered by students well?

Kamol & Ban Har [1] states that in order to improve students' learning in mathematics, it is necessary to understand the developmental mode of their thinking and reasoning. Learning is planned based on the needs and characteristics of students and directed to the changing of students' behavior according to the objectives will be achieved [2]. In addition, in order to support the implementation of mathematics learning in schools, it should be structured the concept of mathematics curriculum used clearly and in focused [3]. Thus, in order to make mathematics learning in school run well, the teacher must design a learning process with clear directions and learning objectives.

Considering the importance of learning objectives in mathematics learning, it is required the guidelines to formulate appropriate learning objectives for teachers. For this purpose, some experts have

classified the learning objectives in a model called education taxonomy. One of education taxonomy that is often used is Bloom's Taxonomy.

Bloom's taxonomy divides the learning objectives into three aspects, namely cognitive, affective, and psychomotor. But in reality, the learning objective that is often highlighted by teacher is only cognitive aspect, while other aspects are not integrated in the learning, whereas in completing a task or problem, it is not only the cognitive aspect that plays a role.

Marzano & Kendall tried to answer the issues of Bloom's taxonomy by establishing a new model of taxonomy, i.e Marzano's Taxonomy. This taxonomy answered the limitations of Bloom's taxonomy. Marzano & Kendall developed a model of taxonomy that combines the wide range factors that affect on how students think [4]. Marzano's taxonomy model contains three mental system: self-system, metacognitive system, and cognitive systems. The fourth component of this model is domain of knowledge.

The self-system includes a network of beliefs and goals that are interconnected which is used to make decisions about the appropriateness of involvement in a task. The metacognitive system is responsible for making purposes related to new tasks and designing strategies to achieve goals that have been made. The cognitive system is responsible for processing information effectively for the completion of tasks. The cognitive system has four levels, namely retrieval, comprehension, analysis, and knowledge utilization. These three systems require domain of knowledge that will affect the success of students in facing every task. Simply, the model of Marzano's taxonomy is stages in thinking and learning that is begun with remember, comprehend, analyze, and utilize the knowledge gained by using prior knowledge.

Actually, the stages in Marzano's taxonomy had been taught by the Prophet Muhammad SAW in interacting with al-Qur'an. As said by Sahabah that "We do not pass without even one verse with the Prophet unless we read, memorize, understand, and implement it" [5].

The Prophet has pointed out how he had a complete interaction with al-Qur'an, start from pronouncing, memorizing, contemplating and also implementing al-Qur'an. Similarly, in teaching of al-Qur'an, the Prophet always prioritized aspects of memorizing, understanding, and implementation as mentioned in an *atsar* of Abu ʻAbd al-Rahman al-Sulami. He said:

حَدَّثَنَا مَنْ كَانَ يُقْرِئُنَا مِنْ أَصْحَابِ رَسُولِ اللَّهِ - صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ -أَنَّهُمْ كَانُوا يَأْخُذُونَ مِنْ رَسُولِ اللَّهِ - صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ - عَشْرَ آيَاتٍ فَلاَ يَأْخُذُونَ فِي الْعَشْرِ الْأُخْرَى حَتَّى يَعْلَمُوا مَا فِي هَذِهِ مِنَ الْعِلْمِ وَالْعَمَلِ. قَالَ: فَيُعَلِّمُنَا الْعِلْمَ وَالْعَمَلَ [6].

> Had met me people who have read al-Qur'an at us from Sahabah of the Prophet Muhammad SAW, that if they learn ten verses from the Prophet, they did not continue the ten verses later until they know the knowledge and implementation. They said: We learn the knowledge and implementation all at once.

Fahmi Jiwanto Islam, a prominent Islamic education, has described the stages of the Prophet in interacting with al-Qur'an above into a theory called *Marâtib Qirâ'ah Al-Qur'an. Maratib qira'ah al-Qur'an* consists of six stages, namely *talaffuẓ* (pronunciation), *tafahhum* (understanding), *tadabbur* (contemplation), *tafakkur* (thinking), *takhassyu*'(heartssolemn), and *tanfiẓ* (implementation). These stages can not be separated from one another and these are a one whole unit to be able to study al-Qur'an perfectly.

Based on the description above, then the problem deserves to be studied more deeply by conducting research to formulate integration of *marâtib qirâ'ah al-Qur'an* and Marzano's taxonomy. This integration combines the concept *marâtib qirâ'ah al-Qur'an* with Marzano's taxonomy into one whole unit. From this integration, can be produced a new concept about the classification of learning objectives that is more comprehensive and can be used as a basis formulation of mathematics learning objectives.

II. RESEARCH METHOD

This research is a development research. Development research is a type of research carried out to develop, deepen, or expand knowledge (education) that already exist [7]. In this case, the researchers will develop a new taxonomy in theory by integrating *Marâtib Qirâ'ah Al-Qur'an* and Marzano's Taxonomy as a basis for formulating learning objectives.

Based on the focus of research, the research was carried out through several stages. *First*, translating the book of *marâtib qirâ'ah al-Qur'an* with the help of an expert in Arabic. Then proceed to

do literature study about *marâtib qirâ'ah al-Qur'an* and Marzano's taxonomy. At this stage, the researchers also conducted interviews to the expert of Arabic and Qur'an Education regarding *marâtib qirâ'ah al-Qur'an* and its relevance to Marzano's taxonomy.

Second, developing by combining the concept of *marâtib qirâ'ah al-Qur'an* with Marzano's taxonomy based on the data that has been collected. This stage produces an early research product in draft integration result of *marâtib qirâ'ah al-Qur'an* with Marzano's taxonomy. Then, the draft was discussed with expert of Qur'an Education and the lecturer of Mathematics Education in a sustainable manner to obtain a logical result and answerable.

Third, making a conclusion based on the results of discussions with the experts. At this stage, the researchers developed the concept of integration of *marâtib qirâ'ah al-Qur'an* with Marzano's taxonomy overall, including the description of integration result and the indication of learning achievement in all levels of integration result. In addition, it's also provided the examples of its application in formulating mathematics learning objectives.

In this research, data were collected by using refer to note technique and interviews. Refer to note technique is a technique of data collection by using books, literature or library materials, then note or citing expert opinion that is in the book [8]. Then, the collected data was analyzed by inductively, annotated bibliography, and content analysis. This was done to be able to find the key points of each stage in *marâtib qirâ'ah al-Qur'an* and Marzano's taxonomy. The results of this analysis were used to compose the draft of integration result which consists of definition and goals to be achieved at each stage in *marâtib qirâ'ah al-Qur'an*, Marzano's taxonomy, and the results of integration of both.

III. RESULT AND DISCUSSION

Marâtib qirâ'ah al-Qur'an is the stages of studying al-Qur'an carried out by a Muslim in order that al-Qur'an can be studied as a whole. This theory reviews the stages of studying al-Qur'an. In theory, there are six stages in the review of al-Qur'an. The definition of each stages can be seen in Table 1.

TABLE1. THE DEFINITION OF EACH STAGES IN MARÂTIB QIRÂ'AH AL-QUR'AN

Stages	Definition
1. *Talaffuẓ* (Pronunciation)	Reading al-Qur'an in accordance with the correct pronunciation, performed, and pronounced correctly.
2. *Tafahhum* (Understanding)	Understanding the meaning of the verses of al-Qur'an literally and its content.
3. *Tadabbur* (Contemplation)	Thinking by using the entire intellectual and logical questions to reach a new understanding, which is contained in the texts of al-Qur'an in accordance with the rules of the Arabic language, both connecting between sentences in al-Qur'an and letters in al-Qur'an.
4. *Tafakkur* (Thinking)	Thorough exploration process by contrasting from the meaning of *qauliyyah* verses (text of al-Qur'an) towards reading and analyzing of *kauniyyah* verses (universe) to generate some rules or lessons as a solution to a problem.
5. *Takhassyu*' (Solemn Heart)	Solemn mood as an effect received from the process of *talaffuẓ*, *tafahhum*, *tadabbur*, and *tafakkur* the verses of al-Qur'an.
6. *Tanfiẓ* (Implementation)	Conceiving and realizing the teachings of al-Qur'an in the life whole-heartedly in all aspects of life.

Marzano's taxonomy is a taxonomy of learning objectives to systematically define the variety of skills related to thinking and learning. Marzano's taxonomy reviews a process of student learning and thinking. This taxonomy is organized into 6 levels. The definition of each level in Marzano's taxonomy can be seen in Table 2 below.

TABLE 2. THE DEFINITION OF EACH LEVEL IN MARZANO'S TAXONOMY

Levels	Definition
1. Retrieval	A process of recalling already known knowledge, without necessarily understanding what he/she knows about it.
2. Comprehension	A process of organizing or managing existing knowledge, synthesizing representation (the ability of collecting the same components to form a new thought patterns), the steps are still rudimentary in understanding the basic or initial concept.
3. Analysis	A process of reaching and testing the suitability of knowledge of both the similarities and differences, analyzing the relationships upwards and downwards, classifying, analyzing errors, generalizing, specifying or for a logical consequence or the principle that can forma conclusion.
4. Knowledge utilization	A process of utilizing knowledge which could be a reference or solution, decision making, a question of

Levels	Definition
	experiment and can solve an application related to knowledge.
5. Metacognitive system	A process of monitoring and managing the various objectives of already understood knowledge and maintaining the level of achievement of these goals.
6. Self-system	A process of identifying emotional response, examining perception and self-motivation, testing self-benefit, deciding whether to continue daily habits or choose to reflect into a new activity.

Both of those theories above have relevance one another; reviewing someone's stages in learning. Based on that relevance, can be formed an integration that combines the concept of *marâtib qirâ'ah al-Qur'an* with Marzano's taxonomy into wholy unified concept. This integration produces new concept about the classification of learning objectives that more comprehensive, and can be used as a basis formulation of mathematics learning objectives. Briefly, this integration can be seen in Table 3.

TABLE 3. THE INTEGRATION OF MARÂTIB QIRÂ'AH AL-QUR'AN AND MARZANO'S TAXONOMY

Marâtib Qirâ'ah Al-Qur'an	**Marzano's Taxonomy**	**The Result of Integration**	
		Levels	**Definition**
Talaffuẓ	*Retrieval*	1. Retrieving knowledge (Integration of *talaffuẓ* and retrieval)	A process of remembering, recognizing, and executing already known knowledge correctly.
Tafahhum	*Comprehension*	2. Comprehending knowledge (Integration of *tafahhum* and comprehension)	A process of understanding, symbolizing, identifying and categorizing new knowledge as a basic understanding.
Tadabbur	*Analysis*	3. Analyzing knowledge (Integration of *tadabbur* and analysis)	A process of thinking about a meaning of knowledge in depth, which is carried out by comparing, classifying, concluding (specifying or generalizing), and analyzing errors the knowledge to generate new knowledge.
Tafakkur	*Knowledge utilization*	4. Utilizing knowledge (Integration of *tafakkur* and knowledge utilization)	A process of utilizing already known knowledge and juxtaposing with existing natural signs or phenomena as a basis for investigation, experimentation, problem solving, and decision making of a problem related to the knowledge.
Takhassyu'	*Metacognitive system*	5. System of self-control (Integration of *takhassyu*', metacognitive system, and self-system)	A system involving self or heart to reach a deeper meaning of already owned knowledge, which is carried out by reflecting a thinking process that has been mastered by students and identifying an emotional response, motivation, and self-benefit of a new task faced by students.
	Self-system		

The levels of integration results are described below.

A. Retrieving knowledge (Integration of talaffuẓ and retrieval)

The first level, retrieving knowledge, was formed by integrating *talaffuẓ* and retrieval. Both of these (*talaffuẓ* and retrieval) have a slice each other, the *talaffuẓ* process goes on by using students' memories about *hijaiyah* letter (how to read and reading rules) in recognizing the verses of al-Qur'an were pronounced, how they should read these verses with correct recitation rule. This is similar to the processing knowledge goes on at retrieval level. Based on that slice, it is formed a new definition for level 1 of the integration result.

In the definition, it is obvious that the section taken from *talaffuẓ* is "implementing knowledge correctly". Reading, performed and pronounced in *talaffuẓ* are merged into one process, executing. While the section taken from retrieval is "recalling already known knowledge". In the retrieval, it is also followed by a process of recognizing and executing already known knowledge correctly. It is suitable with the description of the goals to be achieved in the retrieval level.

Retrieving knowledge is the lowest thinking process in a learning taken by students. When the students face a task in the learning process, they are only required to be able to remember, recognize, or execute the knowledge possessed to complete the task.

In the process of remembering knowledge, the indications that arise are: students can remember, mention, enunciate, pronounce (a name, word, or term), utter, give examples, list, label, and describe (who, what, where, when) based on the information that has been saved. In the process of recognizing knowledge, the indications of achievement are: students can recognize, select and identify from a list, and determine the truth of a statement. While in the process of implementing knowledge,

the indications of achievement are: students can practice, demonstrate, show, equip, and chart based on the knowledge possessed.

Here are examples of mathematics learning objectives and their instrument about fraction at 7th grade that are formulated based on the indications of learning achievement at levels 1.

TABLE 4. THE MATHEMATICS LEARNING OBJECTIVES AND THEIR INSTRUMENT BASED ON THE INDICATIONSOF LEARNING ACHIEVEMENT AT LEVEL 1

Learning Objectives	Instruments
1. Given a fractional number, students can identify the parts of these fractional number.	1. In fractional number $\frac{2}{5}$, which one as the denominator?
2. Students can calculate a multiplication result of any fractional number with integer.	2. What is the result of $18 \times \frac{1}{9}$?

B. Comprehending knowledge (Integration of tafahhum and comprehension)

Comprehending knowledge was formed by integrating *tafahhum* and comprehension. *Tafahhum* is a process to understand the verses of al-Qur'an literally and their content based on the books of *tafsir al-Qur'an*. This means that it is just as a basic understanding of the verses of al-Qur'an. As well as the comprehension, this process is carried out only to understand the basic or initial concept of knowledge. This is the slice of *tafahhum* with comprehension. Based on the slice, then it is formed a new definition for level 2 of the integration result.

In the definition, it is obvious that the section taken from *tafahum* is "understanding new knowledge as a basic understanding". Understanding the meaning literally in *tafahhum* is an analogy to a basic understanding of knowledge. While the section taken from comprehension is "symbolizing, identifying, and categorizing new knowledge as a basic understanding."

Comprehending knowledge is a level 2 thinking process in a learning taken by students. When the students face a task or a problem in the learning process, they are required to be able to understand the knowledge, symbolize it in the form of graphs, diagrams, symbols, or charts, identify the essential elements of knowledge, and put the essential elements in the appropriate category to solve the problem.

In the process of understanding knowledge, the indications of achievement are: students can describe, explain, and elucidate the meaning of certain facts or concepts in knowledge. In the process of symbolizing knowledge, the indications that arise are: students can symbolize, depict, represent, illustrate, draw, visualize, create a graph, create a chart, and create a model of the knowledge possessed.

The next is a process of identifying knowledge. The indications in this process are: students can describe the core part, describe how or why, and paraphrase (reiterating a fact or concept in another form to explain its meaning) the knowledge possessed. While the indications in the process of categorizing knowledge are: students can make a connections between, describe a relationship between, and summarize the knowledge possessed.

Here are examples of mathematics learning objectives and their instrument that are formulated based on the indication of learning achievement at level 2.

TABLE 5. THE MATHEMATICS LEARNING OBJECTIVES AND THEIR INSTRUMENT BASED ON THE INDICATIONS OF LEARNING ACHIEVEMENT AT LEVEL 2

Learning Objectives	Instruments
1. Students can explain the meaning of fractional number in their own words.	1. Explain the meaning of fractional number in their own words!
2. Students can illustrate elements of problem in an image.	2. Ahmad follow a bike racing. During the race, the road is very slippery. After cycled as far as $\frac{1}{4}$ of the track, Ahmad fall. Then he goes racing back. But after taking two-thirds of the track, he fall again and can not continue the race because the bike was badly damaged. Describe in an image Ahmad's race track in accordance with the situation?

C. Analyzing knowledge (Integration of tadabbur and analysis)

Analyzing knowledge is the integration result between *tadabbur* and analysis. Both processes have each slice. *Tadabbur* is carried out to uncover the overall verses of al-Qur'an, to understand

those verses in depth. As well as analysis, this process is carried out to analyze the knowledge possessed overall. Both processes seek to generate new insights and knowledge based on the knowledge possessed.

In the definition of analyzing knowledge, it is obvious that the section taken from *tadabbur* is "thinking about a meaning of knowledge in depth to generate new knowledge". This thinking process is carried out by analyzing texts, reasoning, generalizing thematically, analogizing, associating, *ta'wil*/interpreting, and concluding. While, the section taken from analysis is not quite different with the various processes in *tadabbur*, that is "a process of comparing, classifying, concluding (specifying or generalizing), and analyzing errors of the knowledge to generate new knowledge".

Analyzing knowledge is the level 3 thinking process in a learning taken by students. In this level, students are required to be able to compare, classify, analyze errors, and conclude knowledge, both specify and generalize, to generate new knowledge.

In the process of comparing knowledge, the indications of achievement are: students can associate, compare, differentiate, contrast, analogize with certain knowledge, sort, and categorize various knowledge that has been owned by the students. In the process of classifying knowledge, the indications achievement are: students can identify different kind of knowledge, classify, organize, arrange the knowledge, and identify the broader category.

The next is the process of concluding knowledge, which consists of generalizing and specifying. In the process of generalizing, the indications of achievement are: students can make a certain rule, generalization, or principle; generalize; and conclude based on some specific information. Whereas, the indications of achievement in the process of specification are: students can interpret or *ta'wil* (interpret the implicit meaning) a problem; develop and sustain the argument; and conclude, predict or decide something that will happen.

The latter process is analyzing errors. The indications of achievement in this process are: students can identify a problem, issue, misunderstanding; analyze and diagnose a fault in a certain topic; judge, criticize, and fix it to get a logical and accurate knowledge.

Here are examples of mathematics learning objectives and their instrument that are formulated based on the indication of learning achievement at level 3.

TABLE 6. THE MATHEMATICS LEARNING OBJECTIVES AND THEIR INSTRUMENT BASED ON THE INDICATIONS OF LEARNING ACHIEVEMENT AT LEVEL 3

Learning Objectives	**Instruments**
1. Students can explain the reason why $\frac{a}{b} \div \frac{c}{d}$ is equal to $\frac{a}{b} \times \frac{d}{c}$, which a, b, c, and d are natural numbers.	1. Explain the reason why the division of $\frac{2}{3} \div \frac{11}{12}$ can be written as $\frac{2}{3} \times \frac{12}{11}$!
2. Given few decimal number, students can identify the numbers that can be converted into fractions.	2. Which of the following numbers that can be converted into fractions? a. 3,141592 ... c. 2,1232323 ... b. 0,717273 ... d. 1,987189 ...

D. Utilizing knowledge(Integration of tafakkur with knowledge utilization)

Utilizing knowledge is the integration result between *tafakkur* and knowledge utilization. Both of these have a slice each other, which *tafakkur* process is carried out by starting from the meaning of *qauliyyah* verses (text of al-Qur'an) to the reading and analyzing *kauniyyah* verses (universe) to generate a solution of a problem. As well as knowledge utilization, which is the process of utilizing knowledge that become a reference in solving problems related to knowledge. It shows that in both of these processes, students attempted to use their knowledge to solve a problem related to the knowledge.

In the definition of the level 4 integration results, it is obvious that the section taken from *tafakkur* is "utilizing already known knowledge and juxtaposing with existing natural signs or phenomena". This is carried out to generate a solution of a problem. While the section taken from knowledge utilization is "utilizing already known knowledge as a basis for investigation, experimentation, problem solving, and decision making of a problem related to the knowledge".

Utilizing knowledge is a level 4 thinking process in a learning taken by students. In this level, students are required to conduct an investigation, experimentation, problem solving, and decision making of a problem by utilizing already known knowledge and juxtaposing with existing natural signs or phenomena.

In the process of conducting an investigation, the indications of student achievement are: students can investigate why and how something can happen, examine the characteristics of

something that has been defined, and investigate what would happen if certain treatment or condition is given. In the process of conducting an experiment, the indications of achievement are: students can generate and test hypotheses, test produced ideas, predict what will happen, and determine an explanation of certain theory.

Then, in the process of problem solving, the indications of achievement are: students can resolve and overcome problems associated with the knowledge, find a strategy to solve problems, or develop a way to achieve a goal under certain conditions. While in the decision making process, the indications of achievement are: students may take a decision, consider and choose the best way to achieve a goal based on some options.

Here are examples of mathematics learning objectives and their instrument that are formulated based on the indication of learning achievement at level 4.

TABLE 7. THE MATHEMATICS LEARNING OBJECTIVES AND THEIR INSTRUMENT BASED ON THE INDICATIONS OF LEARNING ACHIEVEMENT AT LEVEL 4

Learning Objectives	Instruments
1. Students can solve a problem related to fractions and tenancy law in real life.	1. Harits has made *ijarah* (tenancy) agreement of Avanza car for homecoming with the deal price of Rp 5,850,000 within a month. After, it's used for 10 days, the car was damaged and Harits decided to cancel the agreement. If the general price within 10 days (the period after using a car) worth Rp 2,500,000 and the general price within 20 days (the period before using a car) worth Rp 4,000,000. So,how much cost of the rent should be paid by Harits for 10 days?
2. Students can develop a strategy to solve a problem related to fractions and inheritance law.	2. Once, there was a father who died and left three sons. He wrote a testament that his heritage in the form of goats was divided by division as follows: - The first son got half $\left(\frac{1}{2}\right)$, - The second son got $\left(\frac{1}{3}\right)$, and - The youngest son got $\left(\frac{1}{9}\right)$. Well, then a problem arose because the number of goats are 17 goats. With simple math, the eldest son should gets $8\frac{1}{2}$goats, the second son gets $5\frac{2}{3}$ goats, and the youngest son will gets $1\frac{8}{9}$ goats. However, they wanted the goats alive. If they divide the goats in that way, there would be few goats to be slaughtered. So, how was the way to divide the goats? Can you help them?

E. System of self-control (Integration of takhassyu', metacognitive system, and self-system)

System of self-control was formed by integrating among *takhassyu*', metacognitive system and self-system. These three processes have slice to one another, that is the involvement of heart, self, or affective side of students in carrying out these three processes. *Takhassyu*' is a process of gaining the deeper meaning of knowledge that has been processed in the previous stages by using heart solemn. As well as metacognitive system and self-system. In both of these systems, students have been involved their affective side in undergoing a learning process, so that they are able to reflect the learning process that they have been mastered, recognize and develop themselves [9].

Additionally, Suryanti [10] states that according to al-Ghazali, *khussyu*' includes six things, namely the presence of heart (*hudhurul qalb*), understanding between the read and done (*tafahhum*), glorifying Allah SWT (*ta'ẓim*), feeling daunted towards Allah SWT (*haibah*), feeling full of hope to Allah SWT (*raja'*), and feeling ashamed to Him (*haya'*). One part of *khussyu*', namely "*tafahhum*" which can be interpreted as conscious or understand, has relevance to the meaning of metacognitive. Metacognitive can be defined as the awareness of thinking process. In this case, metacognitive system is responsible to monitor the thinking process of students in order to operate properly.

While another part of *khussyu*', the "*hudhurul qalb*" which means the presence of heart or self, has relevance to the self-system. The relevance is clearly seen in the self-system,that the system also involve the self in the acquisition of knowledge and thinking processes that had been owned by students. "*Raja*'" or feeling full of hope to Allah SWT, may also be related with the self-system. The feeling full of hope related with self-motivation which is organized in the self-system. These further relevances strengthen the integration among *takhassyu*', metacognitive system and the self-system.

Based on these relevances, then formed a new definition of the level 5 integration result, as set out in Table 3. In the definition of level 5, it is obvious that the section from *takhassyu*' is "a system

involving self or heart to reach a deeper meaning of already owned knowledge". It is obvious, because *takhassyu'* is a process that is carried out after the process of *talaffuẓ*, *tafahhum*, *tadabbur*, and *tafakkur* verses of al-Qur'an. The section taken from the metacognitive system is "a system involving self, which is reflecting a thinking process that has been mastered by students". It refers to the ability to set objectives to be achieved in a task and maintain the level of achievement in these objectives. The section taken from the self-system is "a system involving self, which is identifying an emotional response, motivation, and self-benefit of a new task faced by students".

The system of self-control occupies in level 5 or the last level in a learning taken by students. This system is not a process that has a direct indication. This system only supports the implementation of thinking process and exist inside the self or heart of person. The sign for the success of this system is the success that was also achieved in the thinking process at other levels.

IV. CONCLUSION

Based on the results of research on integration of *Marâtib Qirâ'ah al-Qur'an* and Marzano's Taxonomy and its application in the mathematics learning, then obtained some conclusions as follows. Integration of *marâtib qirâ'ah al-Qur'an* and Marzano's taxonomy produce 5 new levels in the classification of learning objectives that is more comprehensive. Five level, namely: 1) Retrieving knowledge (Integration of *talaffuẓ* with retrieval); 2) Comprehending knowledge (Integration of *tafahhum* with comprehension); 3) Analyzing knowledge (Integration of *tadabbur* with analysis); 4) Utilizing knowledge (Integration of *tafakkur* with knowledge utilization); and 5) System of self-control (Integration of *takhassyu'*, metacognitive system, and self-system).

Indications of learning achievement at any level of the integration results refer to the processes at any level as follows. Retrieving knowledge consists of a process of remembering, recognizing, and executing knowledge. Comprehending knowledge consists of a process of understanding, symbolizing, identifying, and categorizing knowledge. Analyzing knowledge consists of a process of comparing, classifying, analyzing errors, and concluding knowledge, both specifying and generalizing. Utilizing knowledge consists of a process of investigation, experimentation, problem solving, and decision making. System of self-control has no direct indication.

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