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## Developing High Order Thinking Skill in the Context of Mathematical Learning in Primary School

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### ABSTRACT

The purpose of this paper is to describe about high order thinking skill in matematic learning in primary school. High order thinking skills are absolutely necessary for students to equip them in the context of 21<sup>st</sup> learning century. In the primary school, the implementation is embedded in the curriculum framework currently used to develop high order thinking skills in the learning process. In addition, the competency of learning is also affiliated with the achievement of 21<sup>st</sup> learning century skills. The process of learning mathematics, is not purely only learn how to count in the implementation of learning that done. This is in line with the high level of expected competence related to the development of high order thinking skills by referring to the development of 21<sup>st</sup> learning century contexts in the primary school classes. This developed of high order thinking skills refers to Bloom's taxonomy that has been revised by Anderson, *et.al*. Based on these taxonomy, the high order thinking skills is consists of from 3 levels of the 6 levels developed at levels 4 through 6. These three levels among others, are: (1) analyze; (2) evaluation; (3) create. These three levels in the cognitive domain are implemented through a series of mathematics learning processes in primary school. In the process, the development of cognitive abilities at such a high level can be implemented by provising high order thinking skills challenges to enable meaningful learning in the mathematics learning process in primary schools. The result of this paper is we can know and understand at least about mathematical learning process in primary school and how to develop high order thinking skill by referring to the development of 21<sup>st</sup> century learning skills in primary school classes.

**Keywords:** *High order thinking skill, mathematical learning, primary school*

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### Introduction

The context of learning based in the development of the 2013 curriculum that has been revised on 2026 is implemented to develop high order thinking skills that are also capable of developing and optimizing 21st century learning skills better known as 4C's (collaboration, critical thinking and problem solving, communication, and creativity) (Halah Ahmed Alismail, Vol 6, No. 6, 2015). The implementation of the learning process

refers to how students are independently able to develop and optimize both competencies. It becomes a reference to how the learning is carried out. Learning estates are implemented taking into account the circumstances and condition of students related to student's physical and psychological learning readiness from the student.

The learning of the 21st century has major implications for the current series of educational processes. This is due to a shift in

the paradigm of learning that is run. Its as an implication of the 21st century learning context developed impacts on how the learning is carried out. The development of the revised 2013's curriculum in 2016 provides flexibility for teachers to develop the learning process in the skills into one learning development estates implemented.

Mathematics is one of several other subjects that students learn in primary school. Among other subjects, mathematics has different characteristics as well that is carried out. The integrated thematic learning process in primary school doesn't include mathematics in units of particular themes or the whole. It affects the learning of mathematics which is carried out separately in the class itself.

Learning maths in the primary school is conducted as an effort to provide students with learning experiences related to mathematical skills that can be developed. The concept and context of the learning that is conducted leads to how students are able to independently develop mathematical competencies provide benefits and help them to apply in practical life processes. It is a conceptual framework that is projected about how mathematical material can be teoretically developed in practice in the learning process.

The optimization of high order thinking skills in the series of math learning process in primary school is a deffinitive effort to asnwrs the challenges and the development of the current era. The context of learning in the 21st century is answered by the actualization of math learning to develop and optimize high order thinking skills in the classroom. The process of learning mathematics that not only develop the cognitive aspect as the implementation of kwnledge also needs to be followed up by the presentation of learning that is able to optimize and actualize the development of affective, psychomotor, and cognitive fields

simultaneously and synergistically among the sphere in a conceptual framework implemented in step by step learning mathematics especially in primary schools. thus, the high ideals of the future will create a golden generation of 2045 competent in the face and identify various phenomena of globalization is very complex with a comprehensive capital learning experience.

### **High Order Thinking Skills**

High order thinking skills are one of several development concepts that focus on being optimized in today's learning processes. It makes this aspect one of the few priority development concepts when the learning process is implemented. Currently developed 2013 curriculum that has been revised in 2016 after experiencing benchmarking process with global level and has resulted in learning competency mapping on core competence and basic competence of primary and secondary education based on the regulation of the minister of education and culture of the republic of indonesia. All core competence and basic competence after benchmarking processes with existing global standards have improved and developed in terms of factual, conceptual, procedural, and metacognition knowledge within the framework of the curriculum formulated through core competencies and basic competencies of primary and secondary schools.

Factual knowledge is a basic element that experts use in conveying, understanding, and embracing their academic discliplines. Conceptual knowledge os schemes, models, and explicit or implicit theories that demonstrate one's own knowledge can also be assumed as knowledge to solve problems. Procerural knowledge involves specific skills, algorithms techniques, and methods. The knowledge of metacognition is a personal

awareness of a person, where more emphasized to the students to always be aware and responsible for their thinking independently (Penyusun, 2016).

Based on the development of the revised 2013 curriculum in 2016, the development of a high order thinking skills context refers to Bloom’s taxonomy revised by Anderson and Krathwohl in 2001. Based on cognitive levels, Bloom (as Anderson and Krathwohl revised)(Krathwohl, 2001) divide cognitive level in six level, including: (1) remembering; (2) understanding; (3) application; (4) analysis; (5) evaluation; (6) create. From these six levels, identified into two types of levels thinking is low order thinking skills (LOTS) and high order thinking skills (HOTS). Hierarchically, the concept of high and low level thinking can be seen in the following chart.

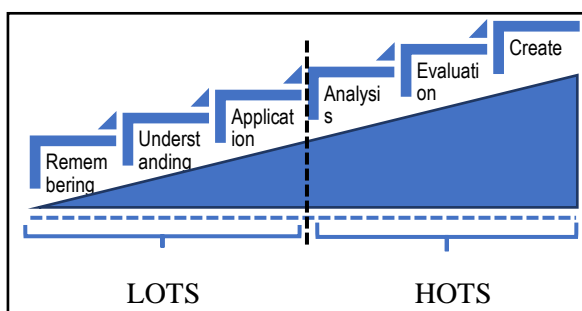


Figure 1. Cognitive level based on the Bloom’s taxonomy (image only illustration) (Revision Anderson, 2001).

Development of high order thinking skill can be developed through a learning processes that stimulate student’s cognitive abilities continually. The process is absolutely done through a series of of lessons that are capable of delivering challenges and higher levels of thinking or above the standard of thinking of existing student competencies. Thus, students will be more accustomed to developing higher-order thinking skills in the context of learning through the correlation of reality in the life processes they experience. In this

process, students should always be given a learning presentation that is able to develop and optimize their analytical, evaluative, and creative skills by adjusting the targeted learning competencies. In addition, students also need to be given a variety of learning experiences that can enter into their long-term memory. So that, the learning process that can optimally develop and optimize high orderthinking skills through meaningful learning process.

The domain of cognitive ability development in high order thinking skills is optimized through a process of learning that has a higher level of thinking. In the process undertaken, students must be able to independently perform the process undertaken, students must be able to independently perform the process of analysis, evaluate, and creating all matters relating to the material that is currently being studied. For example, at level C6 (creating) in the process of learning mathematics in the primary school, students are able to independently determine and find a solution to a mathematical problem in its own way but still pay attention to the realm of completion of a comprehensive problem. This is as can be found in the open-ended model that has an alternative answer more than one. Of course there are many others alternatives that can be done to develop and optimize learning process that leads to the improvement and development of high order thinking skills.

**Math Learning in The Primary Schools**

Learning process is carried out to be able to provide learning experiences to students to be able to master and optimize targeted learning compeencies. In primary school, math learning in one of its development studies the concept of mathematics through conceptual investigation (Frei, 2008). Nevertheless, the praxis in mathematical learning concepts is

developed in a step by step learning that students learn praxis as learning.

In different concepts on learning mathematics, if learning in the context of teaching by teachers, math learning only gives one side of the idea in terms of mathematical thinking. That's as Polya's assumption in Cowan (Cowan, 2006) which states that overall the activity of guessing and developing math concepts of things not seen around students. It's sometimes that makes the teacher neglectful to be able to develop a variety of mathematical skills that can be actually be made something interesting as a student's learning experience. The math concept is also useful for students as a provision of experience in living and facing real life processes in life later. Thus, learn math is not only limited to memorizing and applying math formula but rather to how students with math knowledge and understanding are able to apply in the process of daily life of math concepts in practical life in the real life. It's same as habituation process to make math as something include in real life to help and solve their life's problem and trouble.

Math learning sequences in primary schools are developed with reference to some math concepts and skills. The conceptual framework of own math learning in primary schools is developed with the result of developing students' math thinking skills. This ability is an accumulation of the concept of thinking which indicates the development of the ability: (1) understanding of math; (2) mathematical problem solving; (3) mathematical reasoning; (4) mathematical connection; (5) mathematical communication.

Learn math can make students able to face their real life's trouble. This concepts can be used practically when student understanding math comprehensive. Math understanding is concerned with the student's ability to answer a math question accompanied by the reason

for the answer (why the student concerned assumes that the answer is true on a logical basis). These reason can be definition of a concept, the use of models and symbols to present concepts, the application of a simple calculation, the completion of an algorithmic problem is done correctly and realized step by step is done. According to Adjie and Maulana (Adjie, 2006), problem solving is a process of acceptance of challenges and hard work to solve problem. Similar disclosed Wahyudin (Wahyudin, 2012) states that problem solving is an integral part in learning process of math. Thus, problem solving can't be made as a separate part of the learning process undertaken. In learning math in particular, problem solving is not only a goal of learning, but also as a way to do the learning process itself.

Math connections were popularized by NCTM in 1989 which stated that mathematics is not a partially separate set of partially separate topics and abilities. Although in reality mathematics is often partitioned and studied in several branches ((NCTM, 2000). Math is an integrated science. With this assumption, math need to be viewed as a holistic whole. Looking math as a whole is very important in learning and thinking about the connection structure between topics in mathematics itself. The connection structure between the branches of mathematics allows students to make analytical and analytical mathematical reasoning.

Gilarso in Setyono (Setyono, 2008) states that reasoning is an explanation that shows the connection or relationship between two or more things on a certain basis and with a certain step up to one conclusion. The same thing is said Nico (Nico, 2012) which states that reasoning is a thought to be able to produce a conclusion.

Mathematical communication is one of the mathematical skills that are expected to be

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mastered by students. Mathematical communication involves 3 aspects (Education, 2017), among others: (1) using mathematical language accurately and using it to communicate aspects of problem solving; (2) using accurate mathematical representation to communicate problem solving; (2) present a well-organized and well-structured problem solving.

### **Optimization of High-Level Thinking Skills in Elementary Mathematics Learning**

The optimal learning process can lead the students to understand the targeted competencies as set forth in the learning objectives. Achievement of quality learning process is created by all components of learning as whole unity that has synergicity. Between components to create a series of optimal learning process and quality. In that context, each learning component has its own duties and roles in order to create a quality of educational process.

The consequence of learning process undertaken is need for the development of learning material that really can develop high order thinking skills of students. In addition, the cognitive dimension associated with the concept of matter can be developed theoretically in the context of classroom chronological learning praxis. So the ability to be developed by students is not only limited to knowing and mastering math concept theoretically, but rather to how students are able to apply and implement the theoretical concepts of math material learned in the context of field praxis as the process of life they experience daily. Thus, the learning process that meaningful learning really can be implemented in real class in an optimal manner.

Learning is done to optimize the ability to analyze, evaluate, and create is developed through the learning steps are compiled and implemented through the steps of math learn in the classroom with a focus on learning affiliated with the characteristics of developmental psychology and learning from the students themselves. The factual and actual implementation of learning will provide a valuable learning experience for students in order to make the learning process meaningful.

### **Conclusion**

The learning that provides valuable experience to the students is the estuary of a meaningful series of learning processes. This leads to how the development of learning is implemented in order to create a 2045 gold generation that is ready to face the reality and global phenomenon later. The development and optimization of high-level thinking skills in the learning process of mathematics brings new paradigm in the learning process undertaken. This implies how the learning process is carried out with reference to the development of students physically and psychologically. In addition, the readiness factors of students both physically and psychologically need to be considered related to how the learning process is implemented.

Mathematics learning in primary schools as it is, is carried out by observing how students are able to develop the process of thinking mathematically. In that context, there is a wedge between what is developed in terms of high-level thinking skills with students' mathematical thinking. The development and optimization of students' ability to analyze, evaluate, and create is aligned with how students are able to develop math comprehension skills, mathematical problem solving, mathematical reasoning,

mathematical connections, and mathematical communication.

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