

## Higher Order Tingking Skills (Hots) In Math Learning

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**Abstract:** The main issues raised in this paper are the ability to think in mengkosntruksi and solve problems related to learning mathematics. The development of science and technology with high technology such as computers or other media has changed the learning of mathematics. This shows not only the aspects of mathematics learning but also how the learning process of mathematics is implemented and how one's attitude toward mathematics. The learning of school mathematics today is still far from high-level thinking skills. Implementation of learning more on the target achievement of learning outcomes by looking at the completeness of learning (final grade) students alone without paying attention to skills required by learners in solving mathematics learning problems. The essentials in high-level skills (HOTS) are the learners' skills in problem solving, questioning skills, reasoning skills, communication skills and skillualization skills. These skills will be realized if the learner is able to design mathematics learning well and more on the interwoven way of learning mathematics, and using mathematical knowledge that is considered important in learning mathematics.

**Keywords:** problem solving skills, questioning skills, reasoning skills, communication skills, skill conceptualization

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Date of Submission: 21-08-2017

Date of acceptance: 28-09-2017

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### I. Introduction

This paper deals with the implementation of school mathematics learning relating to how learning should be implemented in learning activities, both in the classroom and outside the classroom. In the learning process, learners are often too preoccupied with delivering the material so that learners are less likely to respond because they are only on duty to listen and are only occasionally given the opportunity to ask questions. In addition, the learner feels the material to be given in one year of learning is too much, so the learner must pursue the target and hasten in completing the material. This certainly results in the level of understanding of the material by the learner. In addition, the skills of the learner in solving the problem is low so it affects the learning outcomes.

### II. Discussion

#### A. Problem Solving

Skill Problem-solving skills are one's basic ability to solve a problem that involves critical, logical, and systematic thinking. Kaya, *et al* (2014) states that problem-solving skills are basic skills that must be possessed and can be used in various areas of everyday life. The importance of being given mathematical problems is inseparable from its role in life, namely to develop a person's ability in dealing with a problem.

In learning mathematics, problem solving skills have an important role that is as an initial ability for students in formulating concepts and capital success for students in solving mathematical problems. Nurdalilah, *et al* (2010) states that problem solving is a part of a very important mathematics curriculum because in the learning process and completion, students may gain experience using the knowledge and skills they already have to apply to non-routine problem solving. Memnun, *et al* (2012) also suggests that enabling individuals to acquire problem-solving skills and training individuals who can address the problems encountered during their real life, are the priority goals and main objectives of today's education. This shows that problem solving skills have an important role in education. Sumarmo (2000: 8) argues that problem solving is a process to overcome difficulties encountered to achieve a desired goal. Montague (2007) says that mathematical problem solving is a complex cognitive activity accompanied by a number of processes and strategies.

According to Polya (Hamiyah and Jauhar, 2014: 17), problem solving skills contain four indicators: 1) understanding the problem, 2) planning the settlement, 3) resolving the problem as planned, and 4) re-checking all steps. Jacobsen, Eggen, and Kauchak (2009: 250) problem solving has two objectives: (1) The short-term goal is for students to be able to solve problems and to understand the content behind the problem; (2) The long-

term goal is for students to understand the problem-solving process and develop as a self-directed learning (students organize and control their own learning).

Baroody & Niskayuna (1993) classified three problem-solving interpretations: problem-solving as an approach, goal, and process of learning. Problem solving as an approach means learning begins with problems, then students are given the opportunity to discover and reconstruct mathematical concepts. Problem solving as a goal relates to the question of why mathematics is taught and what is the purpose of teaching mathematics. Problem solving as a process is an activity that prioritizes the importance of procedures steps, strategies or ways that students do to solve problems to find answers.

Content Standards (SI), which have already been implemented in Regulation of national education minister Number 22 (National Education Department, 2006). The Minister states that the mathematics lesson aims to enable students (1) to understand mathematical concepts, to explain the interconnectedness of concepts and apply concepts or algorithms, flexibly, accurately, efficiently and appropriately, in solving problems; (2) using reasoning in patterns and traits, performing mathematical manipulations in generalizing, compiling evidence, or explaining mathematical ideas and statements; (3) solve problems that include the ability to understand problems, design mathematical models, complete models and interpret the solutions obtained; (4) communicate ideas with symbols, tables, diagrams, or other media to clarify circumstances or problems; (5) has an appreciation of the usefulness of mathematics in life, which has a curiosity, attention and interest in learning mathematics, as well as a tenacious attitude and confidence in problem solving. Regarding the above five goals.

Fadjar Sadiq (2011: 197) says that "The first lesson objectives above relate to mathematical knowledge, so that students must learn and master mathematical theories; Such as theories of congruence, sequence and series, or numbers. In addition, they must be able to apply or use that knowledge. But the ability to reason, communicate and solve problems is thought to be far more important to the students than if they only have mathematical knowledge only because the peak of successful math learning is when students are able to solve the problems they face." From the above statement, it can be taken to understand that the most important thing in mathematics is owned.

Holmes (1995) states that "The background or reason someone needs to learn to solve mathematical problems is the fact in this twenty-first century that people are capable of solving the problem of living productively". Furthermore, Holmes said, "people who are skilled at solving problems will be able to race their lives, become more productive workers, and understand complex issues related to global society". Thus the problem-solving ability becomes the main goal of learning mathematics among other goals. In mathematics, problem solving involves only two major things, namely: (1) solving problems using existing procedures and (2) solving problems that do not use ordinary procedures, requiring novelty in thought. In Problem Solving this is the second type of problem that becomes the point of stress. So what is said to be a problem is anything that can not be solved by using standard procedures. Today, it is understood that problem solving contains a single component consisting of cognitive abilities, behavioral behavior, and attitudes. Mayer (1983) states that "problem solving as a multiple step process is where the problem solver must find relationships between past experiences (schema) and the problem at hand and then act upon a solution".

Problem-solving skills in mathematics learning are necessary to train learners to get used to dealing with the increasingly complex issues of their lives, not only on math problems but also on issues in other fields of study and problems in everyday life. Therefore, a person's skills to solve problems need to be trained so that someone is able to solve various problems that face.

## **B. Asking Skills**

One way that learners use to recognize materials and concepts is through asking questions of different kinds. Language will help learners gain an understanding. Learners have a very high curiosity. At home, often ask his parents, about something he does not know. However, in schools, sometimes learners fail to continue and facilitate the curiosity of learners well. Although the learner has asked a lot of questions, not all questions get reactions from learners. This is related to the way and the sentence of the question asked by the learner. Therefore, the learner needs to pay attention to the principles and components of the question, as well as implementing a well-asked strategy. Mulyasa (2008: 70) says that questioning skills are an integral part in improving the quality of the learning process and outcomes, which is also a part of success in instructional management and classroom management. Through the skills of asking the teacher is able to detect barriers to thinking processes among students and at the same time can improve and improve the learning process among students. Hasibuan & Moedjiono (2012: 62) asks a verbal remark that asks for a response from someone who is charged. The responses can be knowledge up to the things that are the result of consideration. So, asking is an effective stimulus that encourages thinking ability. Questioning skill is a fundamental skill required for subsequent skills acquisition. The purpose of questions asked by teachers is not only to obtain information, but also to increase the interaction between teachers and students, and between students and students (Anitah, 2009: 7.4). Djamarah (2010: 99) a teacher must master the skills to ask that is as follows: (1) basic questioning skills; (2) advanced questioning skills. Basic inquiring skills include: objectives, wording, structure, centering, shifting, distribution, timing, warmth

and enthusiasm, prompting, and changing cognitive level demands. Further inquiring skills include: classroom usage, taxonomic variations, track queries, timing, and increased interaction between students.

Sanjaya (2011: 35) there are some technical guidance in asking or accepting answers are as follows: (a) show keantusiasan and warmth, (b) give sufficient time to students to think, (c) set the traffic to ask questions, (d) Avoid multiple questions. Furthermore, Marno & Idris (2014: 113) says that in the process of teaching and learning, questions play an important role, because well-constructed questions with appropriate throwing techniques will: (a) increase pupil participation in teaching and learning activities; (B) to arouse students' interest and curiosity about the issue at hand; (C) develop an active mind-set and way of learning from the side, for thinking itself is in fact asking; (D) guide the students' thinking process, because good questions will help the student in determining a good answer; (E) focus students' attention on the issue under discussion.

Wahid (2010: 103) there are types of questions according to Bloom's Taxonomy include: (1) knowledge questions; (2) understanding questions; (3) implementation questions; (4) analysis questions; (5) synthesis question; (6) evaluation questions. Skills in asking questions by teachers are meant to allow feedback between teachers and learners. Learners will have the opportunity to actively participate and think. Asking in learning has a purpose. The purpose of the teacher to question the students according Purwiro Harjati (2008: 1), namely (1) generate interest and curiosity of learners on the subject matter; (2) focusing learners' attention on subject matter or concepts; (3) diagnose special difficulties experienced by learners; (4) develop the way learners learn active; (5) provide opportunities for learners to assimilate information; (6) encouraging learners to put it into discussion; (7) test and measure learners' learning outcomes; And (8) knowing the teacher's success in teaching. Teachers should familiarize themselves with asking students questions to create student centered learning. The selected form of questioning is tailored to the purpose, purpose, and significance. The question "do you understand?" Is good, but will become more meaningful if it is changed to "whatever you have understood?" (Mast, 2002: 16). The success of a learning process, one of which is influenced by the skill of asking done by the learner. Learners will be motivated in learning. Therefore, the teacher (lecturer) should be careful in asking questions to keep the interest of students (students) on the subject matter or lectures delivered.

### **C. The Skill of Reasoning**

The ability to reason is closely related to how humans reach certain conclusions from both direct and indirect statements. Daldiyono (2006: 135) said that reasoning is a process of thinking in drawing a conclusion in the form of knowledge. Reasoning includes the ability to think logically and systematically is the highest cognitive domain. Dominowski (2002: 57) states reasoning is a special kind of problem solving. In other words, reasoning is a particular part of the problem-solving work that is thus a part of math (doing mathematics). Reasoning is a skill that can be trained and developed. According to NCTM (2000: 56), mathematical reasoning is a habit, and like any other custom, it must be developed through consistent usage and in various contexts.

Knowledge is shaped by rational, logical thinking or arguments. The thought process is thinking or reasoning. Logic is something that is phrased, a perimbangan of mind, word, conversation, or expression through language (Rapar, 1996: 9). Suariasumantri (1998: 43) reasoning is an activity of thinking that has certain characteristics that is logical and analytic. Anderson (1985: 3) says reason refers to a process of judging and arguing logically. Reasoning is a logical and purposeful argument. Small (1996: 256), reasoning is an explanation that shows the connection or relationship between two or more things on a particular basis and with certain steps to the conclusion. Furthermore, Santrock (2008: 358), argues that reasoning is a logical thinking that uses inductive and deductive to draw conclusions. Barbey and Barsalou (2008: 35) say that reasoning is a sign of human thinking, supporting the discovery process that can lead from what is known or that can be inferred to what is implied in a thought.

Further Principles and Standards (NCTM, 2000: 342), mathematical reasoning standards include (a) recognizing reason as a fundamental aspect of mathematics; (b) create and investigate mathematical guesses; (c) developing and evaluating mathematical arguments; and (d) selecting and using various types of reasoning. Malloy (1999: 13) says teacher and student questions are a strategy to help children use their potential reasoning against mathematical objects. For that, learning in the classroom should be designed so that children dare to express their minds without having to feel shy or afraid of being laughed at, and each child contributing by assessing and responding to his friend's thoughts. Mathematical reasoning is a basic mathematical skill that must be mastered by high school students. Broadly speaking there are two types of reasoning, namely inductive reasoning which is called also induction and deductive reasoning. The difference between deduction and induction on the basis of inferred inferences (Yanto & Utari, 2007: 116).

Reasoning is a tool for understanding mathematics and the mathematical understanding it uses to solve problems. The problem-solving experience in turn reinforces mathematical reasoning and reasoning which then returns to capital to solve new problems or other problems that are of course more complex and complex.

#### D. Communication Skill

One of the process skills demanded by the current curriculum is communication skills such as every researcher is required to be able to convey the results of his invention to others. The results can be submitted in the form of a research report or paper, can also be delivered orally. Often the results of such research are made in the form of drawings, models, tables, graphs or histograms. Skills to communicate what was found is one of the fundamental skills that are required in the learning process, on the basis that learners need to train learners in this skill. Communication skills are indispensable for achieving success in learning. With communication skills, students will easily communicate various matters relating to learning materials, both oral and written. Communication between humans use interface in the form of symbols the emblem in the form of spoken language, written language, body language and others, so that the message is easy to understand and be understood by the recipient of the message. If each party who communicates understand and understand what is meant then the relationship will be smooth, vice versa. Therefore communication is the process of operation of the content of messages in the form of symbols from the sender to the recipient of the message.

Communication can be interpreted as an interpersonal process in sending and receiving meaningful symbols for their interests (Widjaja, 2008: 150). One of the indicators that can be used to improve student learning process is communication skill. Communication allows students to be able to exchange information or ideas as their need. Communication is a process of delivering messages (ideas, ideas) from one party to the other so that there is mutual influence between the two. Generally communication is done using words that can be understood by both parties. Through communication, the attitudes and feelings of a person or group of people can be understood by others (Mashudi, 2013: 103). Based on some of the opinions of the authors to conclude that the learners' communication skills are skills in verbal and nonverbal communication techniques used in speech and hearing in interacting with learners who are mutually supportive in learning activities.

Santrock (2007: 55) divides communication skills into three main aspects namely, (1) speaking skills; (2) listening skills; (3) non verbal communication skills. Speech skills include speaking skills in front of the classroom and students, using a communication style that does not give the impression of judging the other person, being assertive and giving an effective lecture. Listening skills is the ability to listen actively. Active listening skills are indicated with attentiveness. Non-verbal communication skills ie communication skills through facial expressions and eyes, touch, space and silence. Communication skills through facial expressions such as smiles, frowns, confusion stare. Communication has a very important function in the implementation of learning in the classroom, especially in learning mathematics. Brent D. RaRuben (in Soyomukti, 2010: 88), among others: 1) Coordinate the activities of individuals, groups, or other units within the organization; 2) Provide overall organizational direction; 3) Facilitating the exchange of information within the organization; and, 4) Ensure a reliable flow of information between the organization and the external environment (outside) of the organization.

#### E. Skeptualization of Skills

Understanding of something (concepts) makes students able to give arguments about the material that has been learned, not just to know and remember what has been learned, for that if students really understand a concept is not impossible for students able to pass through the stages of cognitive next. Usman (2006: 33) said that the concept is very important in learning mathematics, because the mastery of the concept will greatly assist students in the mastery of mathematics. Understanding of the concept itself is diverse. According to Gagne, "concept is an abstract idea that allows us to group objects (objects) into instances and non-examples. Where the concept can be formed by learning to see (recognize) the nature of concrete objects, or events to be a group. So, if one can recognize objects or events as a group, class, class or category, then he has learned the concept (Nasution, 2008: 138).

Chaplin (1989) mentions that the notion of concept includes: (a) one idea or common sense composed of words, symbols and signs; (B) one idea that combines, several elements of different sources into a single idea (Mulyati, 2005: 53). According to Eggen and Kauchak (2009: 98), the concept is an idea that refers to a group or category, in which all its members share some common characteristics ". To teach a concept of Eggen and Kauchak to formulate it into three namely: Superordinat that connects a concept with a broader concept, Coordinate, namely: linking the concepts are interconnected and Subordinate namely: the relationship between two concepts that have reciprocal relationship (Eggen, *et al.*, 1993: 193). While according to Dienes "concept is the structure of mathematics, where the concept is divided into 3", namely: pure mathematical concepts related to grouping numbers and relationships between numbers, notation concepts are the properties of numbers as a consequence of representation, the concept used is the application of the concept of mathematical notation and purely in mathematical problem solving, and related fields of study. To understand a concept students need to look at various examples, so that students will gain a more correct appreciation, and can apply the concept into other situations (Ruseffendi, 1980: 135).

Concerning the grouping of the above concept "Bolton (1977) distinguishes concepts into three types: physical concepts, mathematical logic concepts, and philosophical concepts" (Hardi, 2000: 104). Physical concept is a concept that the object is mentioned directly, the concept of mathematical logic is a concept whose object is not mentioned directly, but only refers to the structure of behavior and operation in dealing with an object, while the philosophical concept is a concept that closely relates to the quality of the object itself. Based on the experience and observations of the author on some learning activities of mathematics in school, many students who experience misconception in mathematics. This is mostly due to teachers' mistakes in the delivery of materials, or teachers who present the material does not understand the concept presented. The definition of misconception here is the student's mistake in understanding a concept that occurs repeatedly.

Yuliani (2003: 23) to understand the concepts contained in mathematics, students should learn by actively berpartisipasi as do experiments to find the concept. The ability of students to differentiate, categorize and name something that causes the emergence of a stimulus in understanding a concept. Based on the above description, then the concept is meant an abstract idea that will be used to group the objects into the sample and not an example of those objects. Thus the students must understand very well about the concepts they are learning today, so that future learning goes well, because each learned concepts are interrelated. In addition, when students learn concepts, students will learn to associate one idea with another idea, so that here happens the process of thinking students analytically.

In mathematics learning there are various concepts that must be understood by students, and students are required to be able to master the concepts that exist as possible. This is in keeping with Bruner's opinion that "learning mathematics is to learn about the concepts and structures of mathematics contained in the material being studied, and to seek out the relationships between concepts and mathematical structures" (Herman 1990: 48). Teachers can know the ability and understanding of students to a given concept, especially in math lessons by looking at what the students do themselves, for example students can mention the characteristics of a concept, distinguish the example and not the example, and even can solve the problem. Students are said to understand a concept in mathematics, or understand the concepts given in mathematics learning, if they are able to solve a problem in accordance with the concepts that have been studied. In addition, students can also find and explain, the connection of another concept that has been given first.

Skills may refer to the specific action displayed or on the nature in which the skill is exercised. Many activities are regarded as a skill, or consist of some skills and degree of mastery achieved by a person describing his or her skill level. This can happen because of a commonly accepted practice of stating that one or more refined patterns or behaviors can be called skills, such as writing, playing a guitar or piano, tuning a machine, walking, running, jumping, and so on. If this is used, then the word 'skill' is meant as a noun. On the other hand, skill can also be used as an adjective, even if it is used, the word has changed its structure to just being skilled. This word is used to indicate a level of success in performing a task.

Taking into account the conditions of the two things described above, the term 'skill' must be defined in two ways. *First*, by referring to it as a noun, which refers to a particular activity which corresponds to a set of motions that must be fulfilled to be called a skill. *Second*, by considering it as an adjective. What people have done so far in relation to the term new skills is limited to the definition of definitions in the latter context. Schmidt (1991) tries to illustrate the definition of such skills by borrowing the definitions created by E.R. Guthrie, who says that: "Skill is the ability to make the final result with maximum certainty and minimum energy and time expenditure." While Singer (1980) states that "skills are consistent degrees of success in achieving an objective efficiently and effectively."

Thus, the skill describes a person's ability to do something. Skeptical conceptualization means the ability of students to understand a particular concept in the activity or learning process and can be applied in real life.

### **III. Conclusion**

The importance of high-level thinking in learning mathematics can improve the critical thinking skills of students or students and the ability of students in solving problems, questioning skills, reasoning skills, communication skills and skillualization skills. These skills will be realized if the learner is able to design mathematics learning well and more on the interwoven way of learning mathematics, and using mathematical knowledge that is considered important in learning mathematics.

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Aleksius Madu. "Higher Order Thinking Skills (Hots) In Math Learning." *IOSR Journal of Mathematics (IOSR-JM)*, vol. 13, no. 5, 2017, pp. 70–75