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The Importance of Mathematical Power in Mathematics Learning

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ABSTRACT

There are still a lot of students have learning difficulties and obstacles in mathematics learning both practical and emotional problems. Based on these problems the teacher has the challenge to solve the case of learning difficulties, why these cases happen and find a solution how to help students be successful in mathematics learning. The aim of this article is to explain the importance of mathematical power to improve student achievement in mathematics learning optimally.

Key Word: mathematical power, mathematics learning

INTRODUCTION

Mathematics is one of the branches of science that contributed greatly to the advancement of science and technology. Given the magnitude of the role of mathematics in transforming human civilization into a branch of mathematics that must be mastered by the students of the primary school level.

The important role of mathematics recognized Cockcroft (1986: 1), for example, he writes: "*It would be very difficult – perhaps impossible – to live a normal life in very many parts of the world in the twentieth century without making use of mathematics of some kind.*" It would be very difficult or not possible for a person to live on the earth in the 20th century without the slightest utilize mathematics.

One of the problems facing education in Indonesia is the problem of the lack of learning process. In the learning process, students are less encouraged to develop the ability to think. The learning process in the classroom more focused on students' ability to memorize information, the brain is forced students to remember and hoard a variety of information without being required to understand the information that is remembered and constructed into meaningful learning experiences. Instead result in the student's ability to memorize information only theoretically smart, but they are poor applications.

Some cases in mathematics ranging from the low learning achievement, lack of interest in students to study mathematics, mathematical incompetence, easily

give up and do not like a challenge, not doing homework, cheating on tests or national exams and other things were done by the students, indicating the problems are serious enough in mathematics learning that must be addressed immediately.

So far the solutions are teachers or researchers just trying to overcome the problem of low learning outcomes of the external side of the students through the use of models, approaches, methods, and tools of learning but less revealing internal factors students more depth. Basically these problems occur due to lack of teachers to recognize, explore, grow and develop mathematical power that exist in students.

The survey results Programme for International Study Assessment (PISA) in 2012 stated mathematical skills of students Indonesia ranks 64 of 65 countries (PISA 2012-Results). PISA 2012 organizers generally concluded that Indonesian student achievement in mathematics to determine the success and progress of the nation, both in improving the quality of education and in political participation. Increased math skills along with a growing sense of confidence, a sense of ownership for the future as agents of change. Factors mathematical predictors of social and economic changes of the nation (PISA 2012-Results).

Theoretical Study and Discussion

The nature of learning mathematics

Another important thing that must be understood by the teacher before learning of mathematics

in order to successfully achieve the goals of learning, of course, have to understand the nature of learning mathematics itself. Learning related to learning strategies. Learning strategy is a planned series of activities that includes the use of methods and utilization of various resources or the strength of a lesson. Learning strategy designed to achieve a particular goal. Learning strategy also includes approaches, models, methods and techniques specific learning. Learning strategies are the components of a set of materials including activity before learning, and participation of students who are learning the procedures used next activity (Dick and Carey, 2005) Learning is essentially an attempt to make students understand how to learn. In an effort to make students understand how learning can be designed a strategy of learning that puts the interaction with all the learning resources that are likely to achieve the learning objectives and do not put the teacher as the sole source of learning.

Knowing mathematics is doing mathematics. In the study of mathematics necessary to create situations in which students can be active, creative and responsive to the surrounding physical. While studying mathematics students must construct knowledge for themselves. The process of building knowledge can only be done with the exploration activities, justify, describe, discuss, elaborate, investigating, and problem solving (Countryman, 1992).

Constructivism states that knowledge is created or awakened in the mind of the student himself when he tried to organize his new experience based on existing cognitive framework in mind, as stated Bodner (1986: 873): "... knowledge is constructed as the learner strives to organize his or her experience in terms of preexisting mental structures ". Thus, learning mathematics is a process of acquiring knowledge is created or performed by the students themselves through the transformation of experience of the individual student.

Constructivism is a philosophy of learning founded on the premise that by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules mental models", which we use to make sense of our experiences. Learning, therefore, is simply the process of adjusting our mental models to accommodate new experiences (Tran Vui, 2001:3)

As stated Tran Vui, constructivism is a philosophy of learning which is built on the assumption that by reflecting his own experiences, the students

construct their own understanding or build on his experience with the world in which they live. Each student will always result in "mental models" on their own. Thus, learning is a process of simplification in adjusting our mental models to accommodate new experiences. Thus, learning is a process of simplification in adjusting our mental models to accommodate new experiences.

Furthermore, Goldin (Sri Wardhani, 2004) states the mathematical built by humans, so in learning math mathematics knowledge to be built by the students. Learning math becomes more effective if the teacher facilitates the students to find and solve problems by applying meaningful learning.

Meaningful learning experience can only be obtained if the students are learning a teacher gives a chance of creative, innovative, fun and gives students the opportunity to actively participate in the learning. In other words, the true mathematical learning will result in a critical individual, open, and integrity. Not surprisingly, when the committee concluded PISA: mastery of basic mathematical knowledge be ranked increased education in some countries (Koesoema Doni A, Compass, Wednesday, December 11, 2013).

Based on the description of the experts can be made a red line on the nature of mathematics learning is as follows.1) The essence of mathematics is a process of learning how to learn or do math. Learning based on the process of building students' knowledge through interaction with a variety of learning resources. 2) The nature of learning in mathematics is based on the learning processes that are not force students to be able to understand a certain subject matter, and not stuffing theories or certain concepts into the child's brain or mind. 3) Learning math should also have the property of self habituation students to think logically, rationally and systematically to locate, investigate, solve problems and discover science. Learning should give confidence to the students, instead of learning that provides the verbal knowledge. 4) Learning mathematics needs to be packaged in an innovative and creative learning activity that involves students. Mathematics learning activities need to bring learning through inquiry, problem solving, and discovery (reinvention).

Given the results of the 2012 PISA study, there should be a change in the orientation of the curriculum. It also shows the importance of the implementation of the 2013 curriculum pressuring the learning process through a scientific approach that does not burden the students with the content but the essential capabilities necessary

aspect of all citizens to participate in building the country in the future.

Implementation of Curriculum 2013

Curriculum 2013 is a curriculum that promotes the understanding, skills, and character education, students are required to understand the above material, is active in the discussions and presentations, and has manners highly disciplined scientific approach (Kemendikbud.2013).

Scientific approach is the basic concept that embodies, inspire, strengthen, and underlying thinking about how learning methods are applied based on a particular theory. Kemendikbud Research and Development (2013) gives its own conception of a scientific approach to learning that includes the components: observe, inquire, reason, trying, creating, presenting, and communicating.

Mastery of mathematics for student life will be very useful in studies in advanced, practical needs, solve problems in everyday life, the formation of attitudes and patterns of thought (logical thinking, critical, and practical, positive attitude and creative spirit) in the future.

In line with the trend of the above, (Depdiknas. 2006) in the Ministerial Regulation No. 22 of 2006 on content standards, learning mathematics is described that aims to enable students to have the following capabilities:

- a) Understand the concepts of mathematics, describes the relationship between concepts and apply the concepts or algorithms, flexibly, accurately, efficiently, and appropriately, in solving the problem.
- b) Using the pattern and nature of reasoning, mathematical manipulation in making generalizations, compile evidence, or explain mathematical ideas and statements.
- c) Solve problems that include the ability to understand the problem, devised a mathematical model, solve the model and interpret the obtained solution.
- d) Communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or problem.
- e) Have respect for the usefulness of mathematics in life, namely to have curiosity, attention, and interest in studying math, and tenacious attitude and confidence in solving problems.

We all know that to have these abilities is not easy, one reason is still a lot of students have a negative perception of mathematics, not like a challenge, the notion that mathematics is a difficult subject and a full count of the complex.

Given the importance of mathematics learning, a challenge for teachers of mathematics to find solutions to various problems and barriers to student difficulties in learning mathematics through curriculum implementation in 2013, including seeking students who previously did not like maths be excited mathematics, changing the negative perception into a positive perception towards mathematics, so that students have the capabilities as stated in the Ministerial Regulation No. 22 of 2006.

One of the teachers' efforts are urging the implementing learning through scientific approaches to develop the potential in students, so that students see math as a fun thing and the presence of a strong challenge in the study of mathematics. Will eventually grow up to self-awareness, the power of the student is the strength (power) of mathematics or mathematical power.

What is Mathematical Power ?

According to NCTM, mathematical power “ denotes an individual’s capabilities necessary to explore, conjecture and reason logically, as well as the ability to use a variety of mathematical methods effectively to solve nonroutine problems. This notion is based on the fact that mathematics is more than a collection of concepts and skill to be mastered. It includes methods of investigating and reasoning, means of communication, and notions of context. In addition, for each individual it involves the development of personal self-confidence”(NCTM. 1989).

By mathematical power we mean : Engaging in mathematical problem solving; Reasoning mathematically ; connecting what is learned in mathematics with other topics in mathematics, with other disciplines and with daily life; communicating mathematically; gaining confidence in one’s own mathematical ability; and appreciating the value and beauty mathematics (NCTM.1989).

According Muhsetyo (2007), mathematical power is defined as the power of mathematics. Awareness of the importance of mathematical power or force can be obtained by students through meaningful

learning provided by the teacher. Mathematical strength, include the ability to (1) assess, suspect, and logical reasoning, (2) solve the problems that are not routine, (3) communicate about and through mathematics, (4) linking the ideas in the mathematical ideas and between mathematics and other intellectual activity, (5) develop self-confidence, character or characters to search for, evaluate, and use information in a special quantitative and solve problems and make decisions.

Capabilities are included in the mathematical strength as submitted by the NCTM (1989) and Muhsetyo (2007), consistent with the goals of school mathematics instruction as described in the Ministerial Regulation No. 22 Year 2006. Regarding this we can draw a common thread that in the mathematics learning objectives, as contained implicit intent and purpose is to cultivate the mathematical power to the students.

Based on the above discussion, concluded that the mathematical strength is a positive energy that arises from a person who is studying mathematics so that there is a continual challenge (through activities: assessing, suspect, logical reasoning), motivation, pleasure, curiosity, which is actualized through the ability to solve problems and communicate mathematics in everyday life. The things that can raise awareness about the mathematical strength is perseverance, tenacity, effort, motivation, interest, curiosity, and creativity.

Why Mathematical Power Importance ?

Mathematics education reform today is focused on the development of "mathematical power" of each child (NCTM, 1989, p.5), believes can be developed in children who are very young. In a case study (Eileen Phillips^a & Ann Anderson^b .1993) explained that the power of mathematics, problem solving, and decision-flavor strongly related to this preschool children. It is also clear that the mediation of parents - mothers are informed by various perspectives, classroom teachers and researchers mathematics - plays an important role in this development.

Some cases in mathematics ranging from the low student learning outcomes, the lack of interest in learning math, easily give up and do not like a challenge, not doing homework, cheating on tests or exams, and others - others were done by students, fundamentally these things occurs due to low confidence in the ability of students to the field of mathematics to deal with the problem. Lack of confidence is not independent of the strength of weak mathematical power in students, so the impact on the lack of motivation to learn, learning

activities, the challenges facing low morale and low math achievement.

When learning in school teachers often pay less attention to the individual characteristics of the students, both while in the classroom and outside the classroom. Teachers often forget how to "serve and assist" students in the learning process. There were only a teacher attention to students who are good at it, but less attention to students who are less intelligent. Teachers are less sensitive to the learning difficulties experienced by students. Teachers too much to give a message to the students worked so hard and diligently, without providing a solution how to learn. Teachers just proud when many students are good at or able to quickly understand the learning material and succeed in solving the problems repeat, without investigating from where they acquire the problem-solving skills. Is it true that they have the skills of a teacher, or a gain from a tutorial that provides smart steps to resolve the matter.

If we look carefully some students seem to have a good mathematical power. The characteristics of students who have mathematical strength characterized by the emergence of a sense of fun and enthusiasm with their current math, if given the job on a group or individual has always done well and quickly, if you have problems do not hesitate to ask the teacher and other things difficult they will be to solve the challenges in learning. Even without being asked by their teachers are always looking for and resolve their own problems as a form of satisfaction of his heart.

In mathematics, as in any field, knowledge consists of information plus know-how. Know-how in mathematics that leads to mathematical power requires the ability to use information to reason and think creatively and to formulate, solve, and reflect critically on problems (NCTM, 2000). This was in line statement Talman LA (2002), Rose BJ (2002), that the power of mathematical reasoning in particular is a habit in the mind and must be developed through the use of consistent in many contexts.

Basic mathematical power is very important for any individual who will learn math, because it will affect the power of mathematics and how to proceed in individual learning outcomes to gain knowledge, skills and attitudes that will be reflected in the day-to-day behavior. Mathematical strengths also served to spur the success of the students' appreciation of the complexity of interdisciplinary studies.

Broadly speaking, the amount of power or power of mathematics contains the following values:

- 1) Mathematical power play proceeds and results affect the way individuals learn to acquire knowledge, skills and attitudes that will be reflected in the daily live behavior.
- 2) Mathematical power was instrumental in developing self-confidence, critical thinking, reasoning, character or characters to search for, evaluate, communication, and use quantitative information and specials in solving problems and making decisions.
- 3) Mathematical power capable of transforming difficulties into challenges as a form of self-satisfaction.
- 4) Mathematical power also serves to motivate, stimulate appreciation of the complexity of the success of students in interdisciplinary studies.

Students develop mathematical power in itself is an integral part of the development of the professional competence of a teacher. So that students can have mathematical power, then they should be taught by teachers as critical thinkers, creative and innovative, which can realize and simulate this quality in every phase of teaching. Of the conditions that must be raised is the process of mathematics learning in a planned manner to develop the mathematical power berprosesnya think potential students, so as to make the activity meaningful learning "learning how to learn". Here the student should be able to find connections between new knowledge with knowledge already owned by his order there was a meaningful learning process. Therefore, Ausubel stated the following, as quoted by Orton (1987: 34): "*If I had to reduce all of educational psychology to just one principle, I would say this: The most important single factor Influencing learning is what the learner already knows. Ascertain this and teach him accordingly*". It is clear that the prior knowledge of students will determine whether or not a meaningful learning process. The task of the teacher to provide convenience for the students so that they can easily associate with the new experience or knowledge relevant knowledge that already exists in the mind or in the cognitive structure. Learning as that is what we hope will happen in the classes in Indonesia, meaningful learning that has been initiated by David P. Ausubel.

Based on the above, in order to support the effort of learning that can foster mathematical powers, necessary professional and competent teacher is a master teacher of mathematics learning materials, to understand how children learn, understand learning theory, capable of learning innovation that encourages motivation and

learning activities, educating learners, and have a dynamic personality in the planning, implementation and evaluation of learning.

The assessment of students' mathematical power goes beyond measuring how much information they possess to include the extent of their ability and willingness to use, apply, and communicate that information. The assessment should examine the extent to which students have integrated and made sense of information, whether they can apply it to situations that require reasoning and creative thinking, and whether they can use mathematics to communicate their ideas.

An assessment of students' mathematical power is broad in scope and should include all the aspects identified in this standard and determine the extent to which they are integrated. The assessment of mathematical power should not be construed as the assessment of separate or isolated competencies. Although one aspect of mathematical knowledge might be emphasized more than another in a particular assessment, it should remain clear that mathematical power concerns all aspects of mathematical knowledge and their integration.

Conclusion

1. Develop the students' mathematical power by itself is an integral part of the development of the professional competence of a teacher.
2. Mathematical power affects the way individuals process and learning outcomes to gain knowledge, skills and attitudes that will be reflected in the daily live behavior and serve to motivate, stimulate appreciation of the complexity of the success of students in interdisciplinary studies.

Recommendations

Teachers should implement a planned learning mathematics to develop students' mathematical power through the application of innovative and creative learning (constructivist, realistic) which occurs the thinking of students, so as to achieve meaningful learning.

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