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The Use of Problem Based Learning to Improve Higher Order Thinking Skills in Junior Secondary School

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Abstract— The purpose of this article is to describe enhancement of higher order thinking skills in mathematics instruction by using problem based learning model. Higher order thinking skills is the skills in resolving problems in new situations by using knowledge that include critical thinking, creative thinking, and problem solving skills. Indicators of critical thinking skills include the ability to analyze information, the ability hypothesize, and the ability to evaluate and reflect. Indicators of creative thinking skills include the ability to create new ideas, the ability to create new alternatives, and the ability to reflect. Indicators of problem solving skills include the ability to analyze, conceptual and procedural knowledge. Problem based learning is an instructional model that is centered on the student in the learning process where students are presented a variety of real problems or not structured to motivate students to learn and engage students in the greater understanding. The syntax use include present the problems, planning resolution of problems, implementation of planning, presentation, and evaluation.

Keywrds: *problem based learning, higher order thinking skills, mathematics instruction*

I. INTRODUCTION

A. Background

Mathematics is a universal science for underlies the development of modern technology, have an important role in a variety of disciplines, and promote the power of human. Putting mathematics as a subject can to understand, fun, and exciting of course is not easy. Fact in the field of mathematics lessons for students, especially Junior Secondary School is not subject demand because it is considered difficult and boring. Student difficulties in mathematics caused by several things such as the ability to think not yet high, the instruction less than innovative, so are students reluctant to higher think. Memorizing culture is still often done to make students' skills in thinking does not lead to higher order thinking skills. Then, in efforts to solve math problems, students have not been able to explore their thinking to be more critical and creative. Of course it is a high order thinking skills is required. [1]*Higher Order Thinking* a process to think critically and creatively, which in turn can be used by students in completing activities. To overcome some of these factors, we need a innovation in instruction and the willingness of students to change their of thinking to higher order think. Innovation in instruction can be applying with mathematical models of learning more than exciting, innovative, and make students more active in the learning process. Model of instruction is appropriate to the learning objectives to be achieved will make the learning process more fun. *Problem Based Learning* is a learning model can be encourages students to get involved in the learning process. Instruction with problem based learning usually begin with giving problems to the students, so the students can explore the provision of knowledge and develop it to obtain a solution. It certainly can affect the thinking of students in finding solutions to the real problems with the ability to think critically and creatively, so can be promote Higher Order Thinking Skills. [2] The application of the model PBL influences the ability to problem-solving skills. [3]The students can use the problem-solving skills to explore the problems and determine the next syntax. Based on this background shows that the high order thinking skills is important in mathematics, so in this article will discuss the use of Problem

Based Learning to improve Higher Order Thinking Skills in Junior Secondary School.

B. Problem formulation

1. How the use of problem based learning to improve higher order thinking skills?

C. Purpose

1. To describe enhancement of higher order thinking skills in mathematics instruction by using problem based learning model.

D. Benefits

The benefits of this article is to know the importance of high order thinking skills in mathematics instruction. Use of problem based learning models in an effort to improve high order thinking skills effectively in accordance with the existing theory study, so it can be used by teachers and researchers as a benchmark in reviewing the theory so as to assist in innovation instruction and research conducted.

II. KAJIAN TEORI

A. Problem Based Learning (PBL)

1. Definition of Problem Based Learning (PBL)

The learning model is an important element in the learning process, where the presence of a model of learning in the learning process becomes more meaningfully and objectives of the learning will be achieved as desired. [4] Problem based learning is an approach to learning that is characterized by flexibility and diversity that can be applied in various ways and in subjects and different discipline and in diverse contexts as well. Difference and diversity issues that would later be able to motivate the students to solve a problem. [5] The problem-based learning approach, in complex real problems used to motivate students in identifying and researching concepts and principles are needed in working through these problems. [7]Problem Based Learning is recognized as a progressive active learning and student-centered, where the problem of unstructured used as a starting point in the learning process. In addition PBL is an instructional model that is very good for developing critical thinking skills. [8] The problem-based learning is a student-centered approach ynag governing curriculum and learning activities using unstructured problems and problems in the real world. Based on the above definition dapaat some concluded that Problem Based Learning (PBL) is a student-centered learning in which the learning process of students presented a variety of real problems or not structured to motivate students to learn and engage students kepemahaman larger.

2. Characteristics of Problem-based Learning (PBL)

Problem-based learning is based on problem situations confusing and unclear can arouse the curiosity of students and engage students in the inquiry. [8] Characteristics of PBL into six covering the problem as early learning, authentic, investigation and problem solving, interdisciplinary perspective, small group collaboration, and the results and presentation. [6] Problem Based Learning in the curriculum mempuanyai some of the following characteristics: (1) a problem as the starting point of learning, (2) the problem is a real world problem that is unstructured, (3) problems as various perspectives, (4) problems as challenges of knowledge, attitudes and competencies students to identify learning needs and new places of learning, (5) give priority to self-directed learning, (6) utilize various sources of knowledge, use and evaluate information, (7) learning is collaborative, communicative and cooperative, (8) the development of the investigation and problem solving skills ssangat important in determining the solution of the existing problems, (9) the cover in PBL consists of synthesis and integration pemeblajaran, (10) the closure on the process of PBL include evaluation and review the experience of learners and the learning process. [4] Characteristics of PBL are (1) the complex, the fact that there is only one correct answer which is the focus of the organization for learning, (2) the students work in tims to resolve the problem, identify gaps to learn and to develop viable solutions ,

(3) students received new information although learning by myself, (4) the teacher acts as a facilitator, (5) the problem leads to the clinical development of problem-solving abilities. Based bebrapa these opinions can be summed up the characteristics of the model problem based learning includes (1) a real problem as tititk early learning, (2) students as a group seeking solutions to problems real realistic, (3) the problem must be meaningful and it can be a challenge for students to find something the new, (4) students acquire new information to learn on their own as well as from a variety of sources of knowledge, (5) the teacher as facilitator, (6) use of the time, information, amenities are there to get troubleshooting solutions, (7) the students predicted to produce products and present it.

3. Syntax of Problem Based Learning

The purpose of Problem Based Learning is acquiring skills and problem-solving process. [6] Syntax in problem solving is to perform (1) the initial analysis, (2) the development of learning issues, (3) iteration of independent and collaborative problem solving, (4) the integration of new knowledge. Furthermore, students can evaluate and present the solutions obtained. [8]Something similar there are six stages in the model problem based learning that is giving problems, make the stages of problem solving, discovery troubleshooting solutions, assessment of the results of problem solving, presenting the resulting solution, and evaluate. The two theories previously put forward stages in the learning model of problem-based learning begins with administration problems, as well as the opinion by [7] namely (1) the presentation of the problem, (2) planning problem solving, (3) to carry out planning, (4) peyajian issues, and (5) reflection and debriefing. Based on expert opinion can be said to be the stages of learning problems can help students in higher-level thinking. Step-by-step problem-based learning in accordance with efforts to increase higher order thinking skills, namely (1) Presentation of the problem, be used as a starting point for learning sehinggadapat lead students to think critically, (2) planning problem solving, (3) the settlement of the problem, (4) presented the results, and (5) evaluate.

4. Excess problem based learning

The learning model used in the classroom learning process will affect the achievement of learning objectives sertaprestasi student learning. problem based learning has several advantages including: (1) PBL can provide a solid understanding of the basic knowledge-factual and apply; (2) provide opportunities for the development of critical appraisal skills; (3) the environment encourages students to ask questions; and (4) PBL allows students to create their own learning, becoming the basis for professional behavior in the future. It is also stated by [8] that is associated with the real world, encouraging students to learn actively, encouraging the birth of a variety of approaches to learning in an interdisciplinary manner, giving students the opportunity to choose what and how to be learned, encourage the creation of collaborative learning, and improve the quality of education. Based on the opinion of the experts put forward a model of problem based learning is an instructional model that is appropriate in order to increase high-level thinking skills of students in mathematics. Model problem based learning where students focus on learning in the learning process of students presented a variety of real problems or not structured to motivate students to learn and engage students kepemahaman larger.

B. Higher Order Thinking Skills (HOTS)

1. Definisi dan Indikator Higher Order Thinking Skills (HOTS)

Thinking is the cognitive skills to acquire knowledge. The ability to think can be defined as the cognitive processes that segregated into concrete steps that are then used as a guideline thought. Results in cognitive thinking can be seen from the high-level thinking skills HOTS identified using cognitive taxonomy. [9] Cognitive taxonomies are organized schemes for classifying instructional learning targets into various levels of complexity. Furthermore [9]defines the Higher Order Thinking into three categories yanitu, (1) Reviews those that define higher-order thinking in terms

of the transfer, (2) Reviews those that define it in terms of critical thinking, and (3) Reviews those that define it in terms of problem solving. In line with [10] A clear and comprehensive, definition of higher order thinking has the potential to help educators transcend the split between the sciences" problem solving "and the humanities"' critical thinking. ". [1] the higher order thinking skills (HOTS) is divided into two components, critical thinking and creative thinking. Based on the opinion of some experts, we can conclude that HOTS is an ability in resolving problems in new situations by using knowledge. Such capabilities are critical thinking, creativity and the ability pemaecahan problem which is an indicator of high-level thinking skills. The explanation of these three indicators as follows.

a. Critical Thinking

Critical thinking skills is one of the high-level thinking skills that requires students be conscientious and finish a problem or give an opinion. [10]critical thinking abilities are specific cognitive skills that are used when a students exhibits critical behavior". Also according to [11] critical thinking is "reasonable, reflective thinking that is focused on desiding what to believe or do". Furthermore, the proposed [9] which explains that "as many of our readers know, critical thinking focuses on thinking that is reflective and that is directed toward analyzing particular arguments, recognizing fallacies and biases, and reaching Conclusions based on evidence and sound judgment ". Meanwhile, according to [12] argues that "critical thinking is thinking that examines, relates, and evaluates all aspect of the situation or problem. It include gathering, organizing, remembering, and analyzing information. Critical thinking includes the ability to read with understanding and to identity and Necessary extraneous material ". Based on the opinion of several experts can be concluded that critical thinking is a process of reflective thinking to decide what is credible and conducted in accordance with the information accompanied by evidence and good judgment. Indicators of critical thinking is.

1) *Analyzing information*
Collecting and analyzing relevant information on the situation and problems

2) Examines
Decisive step will be carried out according to the analysis of the information and the existing problems.

3) *Reflection and evaluation*
Explain the relevance of existing information, make inferences based on information and good judgment.

2. *Creative thinking*

Similarly, critical thinking, part of HOTS the other is where the critical thinking skills required in this kekmampuan ability to develop problem solving solution and find new solutions to a problem. According to [7] creative thinking is another type of thinking is of interest to educators. This type of thinking is normally associated with cognitive skills and abilities for coming up with novel solutions to problem situations. [9] characteristics of critical thinking is grounded (reasonable), yield (productivity), nonevaluatif, and touch (reflective). [7]creative thinking that is original and reflective thinking and that produces a complex product. According to some opinions can be concluded that creative thinking is a thought process that is original by using the capabilities to menciptkaan new ideas more meaningful. Thus it can be arranged indicators creative thinking as follows.

a. Cogent /reasonable
Combining ideas and use them appropriately in solving a problem

b. Productivity
Make or elaborated new alternative to mrnyelesaiakan a problem.

c. Reflection
Explain the relevance of the steps used in solving problems with information and ideas.

3. Problem solving skills

Before defining the problem solving, the first is to understand what was the problem. [9] Students incur a problem when they want to reach a specific outcome or goal but does not automatically Recognize the proper path or solution to use to reach it. [12] Problem solving is the application of Several rules to a problem not encountered before by the learner. Problem solving does not usually begin with a clear statement of the problem; rather, most problems must be identified in the environment; then they must be defined and represented mentally . [13] there are several indicators that the mathematical problem solving abilities.

1) identify the elements that are known, were asked, and the adequacy of the required elements;
2) formulate a mathematical problem or to develop a mathematical model;
3) implement strategies to solve a variety of problems (similar and new problems) inside or outside of mathematics;
4) explain or interpret the results according the problem of origin;
5) make the conclusion.

Based on some of the above opinion can be concluded that the problem-solving ability is one upon ability to solve a problem by using knowledge. Thus it can be arranged indicator problem solving skills as follows.

1) Analyze (Analyzing)

Menganalasis issue aims to sisiwa can determine the point of the problem, and write it in the form of a symbol so it will be easier for students to determine the steps to be used for resolving the problem.

2) Knowledge koneptual

Conceptual knowledge to assist students in understanding the problems and finding information to create strategies / measures to be used. Conceptual knowledge related to the situation of the problem, the information relefant, mathematical concepts and nature of logic.

3) Knowledge of procedural

Procedural knowledge related to the ability sisiwa in demonstrating measures / strategies used in accordance with the mathematical concept or model that is used in accordance with the problems.

III. CONCLUSION /INFERENCE

Based on the above discussion, the conclusion that can be drawn menganai how the problem based learning can improve HOTS is to see steps PBL models in an effort to improve HOTS tailored to the characteristics, namely PBL.

1. Presentation of the problem as early learning
2. Planning troubleshooting
3. Application design problem solving
4. Presentation
5. Evaluation and debriefing.

REFERENCES

[1] Conklin, W. (2012). *Higher-order thinking skills to develop 21st century learners.* Huntington Beach: shell Educational Publishing, Inc.

[2] Minarni, A. (2012). Pengaruh Pembelajaran Berbasis MasalahTerhadap Kemampuan Pemecahan Masalah Matematis. 91-102

[3] Maggi, S. & Claire H.M. (2004). Foundations of problem based learning. NY: Open University Press.

[4] Baden, M. S. (2007). *A Partical Guide to problem-based learning Online.* NY: Routledge.

[5] Allen, M. J., & yen, W. M. (1979). *Introduction to measurement theory.* Belmont: Wadswort, Inc

[6] Tan, O. (2004). *Enhancing Thinking through Problem-based Learning Approaches: International Perspectives.* Singapura: Cengange Learning.

[7] Arends, R. I., & Kilcher, A. (2010). *Teaching for student learning (becoming an accomplished teacher*). NY: Routledge Ratlor and Francis Group.

[8] Delisle, R. (1997). *How to use Peoblem-Based Learning in the Classroom.* Virginia: ASCD.

[9] Brookhart, S. M. (2010). *How to uses higher-order thinking skills in your classrom.* Alexandria: ASCD.

[10] Lewis, A. & Smith, D. (1993). *Defining higher order thinking.* Theory into practice Vol. 32, Number 3, pp. 131-137, Summer 1993. College of education, The Othio State University.

[11] Ennis, R. H. (1985). *Goals for a critical thinking curriculum. Dalam Costa, A. L. (Ed), Developing minds: a resource book for theaching thinking (pp. 54-57).* Alexandria: ASCD

[12] Krulik, S., & Rudrick, J. A. (1999). *Innovative Task to Improve Critical and Creative Thinking Skill. Dalam Stiff, Lee V. & Curcio, Frances R. (Eds). Developing mathematical reasoning in grades K-12 (pp. 138).* Reston, VA: NCTM

[13] Joyce, B., Weil, M & Calhoun, E. (2009). Methods for Teaching. (terjemahan, Achmad Fawaid & Khoirul Anam).

[14] NCTM. (1989). *Curriculum and Evaluation Standars for School Mathematics.* Reston, VA: NCTM.