Implementation of Problem-Based Learning in terms of Student Mathematical Creative Thinking

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Abstract. One of the goals of mathematics teaching is that students have the ability to think creatively. The ability to think creatively is one of the important factors of learning goals for giving knowledge solely to students will not be much help in everyday life, so learning should be able to develop the attitudes and abilities of students that can help to deal with problems in the future creatively. Creative thinking is a thought process that is able to provide ideas or different ideas that can then be transformed into new knowledge and the answers you need. "Think of creative or divergent thinking is to provide a variety of possible answers based on information supplied by the emphasis on the diversity of answers and suitability". There are four characteristics of creative thinking, namely: fluency (fluency, lose a lot of ideas), flexibility (flexibility, change perspectives with ease), originality (originality, composing something new), and elaboration (elaboration, another idea developed from an idea). Creative thinking is the focus of observation. Therefore, we need a model of learning appropriate to enhance the creative thinking of students is a model Problem-Based Learning (PBL).

1. Introduction

In today's sophisticated and modern times, when computers dominate the whole of life, all humans are required to be creative. Able to adapt to life's rapid changes. To achieve this, education plays a very important role. Education must work hard and strive to create powerful, creative generations. The importance of creativity contained in article 3 of the National Education System Act No. 20 of 2003, on the purpose of national education that expects education can develop the potential of learners to be a pious, noble, capable, creative and also independent. Many topics in school math require knowledge and creative thinking skills, such as the ability to solve problems of everyday life. Much of the mathematical material involves real-life problems such as flat matter and wake-ups.

By because it is, we need a model of learning that can improve students' ability to think creatively natural in problem-solving that involves creative thinking abilities of students are trained to solve and find solutions involving their creative thinking abilities. Model PBL is one f alternative learning model that can develop students' ability to think creatively. According to [9] states that PBL is a learning model that uses real-world problems as a context for students to learn how to think critically and gain the knowledge and skills essential concept of the subject matter. While [4] states that a PBL is a method that can help students develop their ability to think and solve problems as well as master the concepts of established learning. PBL provides students with freedom as well as opportunities for teachers to guide and direct students. PBL supports students to play an active role in the learning...
process through the use of problems related to daily life because these problems will require students to find the data needed to find solutions to problems, think to solve problems given and design a presentation of results.

Based on the description above, it can be concluded that the ability of creative thinking is important in supporting the objectives of the implementation of learning mathematics. To develop students' creative thinking ability, one alternative model that can be used is the PBL learning model.

2. Problem-Based Learning

Problem-based learning is one of the learning models centered on the learner by confronting the learners with the various problems they face in their lives. PBL model is a learning model that presents learning material from making problems as a starting point for discussions that will be analyzed and synthesized in an effort to find solutions or answers by students. Problems can be submitted or given by teachers to students, from students with teachers, or from students themselves, who then made the discussion and sought to solve it as a student learning activity.

According to [18] that PBL is a learning model centered on the learner that empower learners to experiment/lab work, integrate theory and practice and apply their knowledge and skills to develop viable solutions to problems. Whereas [6] defines PBL is a learning method where students learn with facilitated problem-solving. While [3] declared PBL is a student-centered approach, involving students in the investigation of complex problem situations. [2] further states that PBLs regulate interaction among students and place students as centers of learning activities. It is further said by [2] that PBLs are characterized by students working in pairs or in small groups to investigate confusing real-life problems. While [19] states in PBL students are presented with real-life problems that require a decision, or with a real problem that requires a solution. Students usually work in small collaborative groups. The teacher poses a role as a facilitator in the discussion group but does not directly control the investigation process.

According to [13] stated PBL is a learning that gives emphasis on authentic problem solving as it happens in everyday life. Further [13] said that PBL is very effective in helping students develop strong interests and desires in improving their thinking skills. While [4] states that PBL is a method that can help students develop their ability in thinking and solving problems and mastering the concept of learning set.

Based on the above description can be concluded that the PBL is a model of student-centered learning based on math problems that exist in daily life (contextual) so as to stimulate students to be more active in solving math problems in the real world (daily life) by educating in group form.

[1] stated that the syntax of problem-based learning consists of five main phases. The phrases refer to the practical steps undertaken in the learning activities with the PBL, as presented in the following Table 1.

| Phase | Master's Behavior |
|-------|-------------------|
| Phase 1: Provides an orientation about the problem to the students | Teachers discuss learning objectives, describe important logistical needs, and motivate students to engage in problem-solving activities. |
| Phase 2: Organize students for researching | The teacher helps the individual to define and organize learning tasks related to the problem |
| Phase 3: Helping self-investigation and group | Teachers encourage students to men to Purchase the right information, carry out experiments and searching for explanations and solutions. |
| Phase 4: Develop and present artefacts and exhibits. | Teachers assist students in planning and preparing are fax-appropriate artifacts such as reports, video recordings, and model, as well as helping them to pass it on to others. |
| Phase 5: | Teachers help students to reflect on their investigation and the |
Analyze and evaluate troubleshooting processes they use.

3. Creative Thinking

According to [12] creativity is "the ability to think things in new and unusual ways and can produce a unique solution to problems". Similarly, according to [15] states that Creative/diverging thinking is divergent productivity, the synthesis or generation of new, original, need ideas or products. Furthermore [11] suggests that creativity is a healthy mental expression, where mental health is meant here is the ability of a person to think clearly about solving a problem. [15] Creative/diverging thinking is divergent productivity, the synthesis or generation of new, original, need ideas or products. While according to [17] states’ creative thinking is related to all of the perspectives, and a strong belief in any particular perspective may result in a tendency “. Next [5] that creative thinking in mathematics and other fields is a part of life skills that need to be developed especially in the face of an increasingly tighter information and atmosphere. This means that creative thinking of learners will be able to develop well if the learners are able to issue or actualize themselves in accordance with the power of creation so that will get something new way.

Based on the above description can be concluded that Creative Thinking is a process that combines logical and divergent thinking. Think divergent is used to find ideas to solve problems, whereas logical thinking is used to verify these ideas into a creative solution. Where creative thinking is marked by the characteristics of thinking fluency, flexibility, and originality.

According [8] put forward the indicator of creative thinking associated with the characteristics of creative thinking as contained in the following Table 2.

Table 2. Characteristics of Creative Thinking.

| Characteristics Think | Details |
|-----------------------|---------|
| Fluency               | (1) sparked many ideas, many answers, many problem-solving, many questions smoothly; (2) Provide ways or suggestions to do various things; (3) always think of more than one answer. |
| Flexibility           | (1) generate ideas, answers, or Iasi server question, can look at a problem from the point of view different vary; (2) find many alternatives or different directions; (3) able to change way approach or way of thinking. |
| Originality           | (1) capable of giving birth to a phrase new and unique; (2) think about an unusual way to express yourself; (3) able to make combinations of walk-in k prevalent of parts or elements. |

4. PBL and Creative Thinking

Creativity in mathematics is more on the ability of creative thinking. Because in general most of the activities undertaken by someone who learns math is thinking. Some scholars say that creative thinking in mathematics is a combination of logical thinking and divergent thinking based on intuition but in consciousness that takes into account flexibility, eloquence and novelty [16].

[16] describes the components of creative thinking in solutions problems in the following Table 3.

Table 3. Components of Creative Thinking and Problem Solving.

| Solution to problem | Components of Creative Thinking |
|---------------------|---------------------------------|
| Students solve problems with various | Fluency |
solutions and answers.
Students complete (declare) in one way then settlement in another way students discuss various methods
Students check the answers with various methods of completion and then create different new methods.

5. Conclusion
PBL model is an alternative learning model that can improve students' creative thinking skills. With the PBL model students are given the opportunity to think creatively. Another alternative is how to convey material so that students feel happy and understand the material to be studied so that creativity will arise in students including new ideas and ideas that can enhance creativity in learning. This learning model is believed to be able to improve student learning creativity.

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