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PROBLEM-BASED LEARNING: CREATIVE THINKING SKILLS, PROBLEM-SOLVING SKILLS, AND LEARNING OUTCOME OF SEVENTH GRADE STUDENTS

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ABSTRACT

Creative thinking skills and problem-solving skills were among the competencies that must be possessed by students in the 21st-century, which need to be developed through the learning process, and are still teacher challenge to date. This study aims to improve creative thinking skills, problem-solving skills, and learning outcomes of seventh-grade students by problem-based learning (PBL). This class action research was conducted at State Junior High School 18 of Malang. The subjects was students' class VIIE. The study was conducted two cycles (repeated seven times). Each cycle referring to Spiral Model by Kemmis, McTaggart, and Nixon. The problem-solving skills data were obtained from student worksheet assessment, the creative thinking skills data were obtained from performance grading rubric and learning outcomes data were obtained from end-of-cycle essay test. The results shows that PBL improves (1) the average of problem solving skills of 27% with the completion rate of 47%,(2) the average of creative thinking skills of 11% with the completion rate of 17.5%, and (3) the average learning outcomes of 13% with the completion rate of 15%. It can concluded that teachers can implement PBL to improve students' creative thinking skills, problem-solving skills, and learning outcomes.

Keywords: *Creative thinking, knowledge, PBL, problem solving*

INTRODUCTION

The 21st-century skills are one of the most frequently discussed topics of the day. The 21st-century development requires education to prepare learners who are able to face the demands of life, that is having problem-solving skills (Kurniawan, 2016), creative thinking skills (Birgili, 2015; Husamah, 2015a, 2015b), and good cognitive ability (Hidayah, Salimi, & Susiani, 2017; Wijaya, Sudjimat, & Nyoto, 2016). Creative thinking skills are an important aspect to create and find ideas to solve the problem. Creative thinking skills can train students to develop many ideas and arguments, ask questions, acknowledge the truth of the argument, even make students able to be open minded, and responsive to different perspectives (Arifin, 2017; Tendrita, Mahanal, & Zubaidah, 2016).

Many experts believe that the focus of education is to teach students to think, use their rational power, and become a problem-solver (Susiana, 2010; Živkovic, 2016). Problem-solving is an activity that requires a person to choose the way out that can be done in accordance with the ability possessed by someone itself, meaning that the movement between the present condition to the expected condition (Lucenario, Yangco, Punzalan, & Espinosa, 2016; Nuzliah, 2015; Sudarmo & Mariyati, 2017; Winarso, 2014).

The steps in problem-solving are finding and understanding problems, developing good problem-solving strategies, exploring solutions, and thinking/redefining problems and solutions over time (Santrock, 2012; Saragih & Habeahan, 2014). There are several factors that constrain problem-solving: mental sets, negative and positive transfer, and incubation (Sternberg, 2012). Creativity is a way to find problem-solving. Many problems can be solved by creating new ideas or strategies (Nuzliah, 2015).

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Strategy and model of learning that encourage the development of problem-solving skills is very useful for students on aspects of cognitive, psychomotor, and affective (Chang et al., 2017; Scott, 2015). With those accustomed to solving problems in science learning, students will be more trained in thinking skills and problem-solving skills. In addition, learning that encourages the development of problem-solving skills is intended to develop higher-order thinking skills (HOTS) of students (Utaminingsih, Abdurrahman, & Kadaryanto, 2015).

Learning activities should be designed to ensure that students are at the forefront of learning activities or student-centered (Arif, 2015; Husamah, 2015a), to be more creative in creating a conducive class (Schettino, 2016; Yusof, Hassan, Jamaludin, & Harun, 2012), and later on to produce meaningful learning (Chiang & Lee, 2016; Haridza & Irving, 2017; Winarso, 2014), which in this case is to develop creative thinking skills and problem-solving skills. Accordingly, based on observations and evaluations conducted by teachers and research teams in the VIIE class of State Junior High School 18 of Malang city (SJHS 18 of Malang), it is found that learning conditions are: (1) Students easily master the material in theory (2) Students have the ability to collaborate with friends (5) Students have the ability to use laboratory apparatus well (6) Students have the ability to comprehend written readings obtained or given by the teacher. However, the lack of learning process in the VIIE class, namely (1) Students confused when faced with the problem (2) They tend to difficulty in finding ways to solve problems (3) They take a long time to determine how to solve, and (4) lack of skill in determining the solution strategy.

In an effort to overcome these problems, in relation to efforts to improve creative thinking skills, problem-solving skills, and learning outcomes it is necessary to implement Problem-based learning (PBL). PBL is an active learning based on the use of ill-structured problems as a stimulus for learning (Barell, 2010; Chuan et al., 2011; Phungsuk, Viriyavejakul, & Ratanaolarn, 2017) that prioritizes the filing of a problem or question, focusing on the linkages between disciplines, authentic inquiry, collaboration, and produce work or show results (Arends, 2012; Saragih & Habeahan, 2014).

PBL is one of the suggested instructional models to be implemented in science learning by the Ministry of Education and Culture of the Republic of Indonesia (Arif, 2015; A. T. Susanti, Prayitno, & Sudarisman, 2015). The essence of PBL is to present an authentic and meaningful problematic situation to students and can be used as a springboard for investigation (Arends, 2012). The purpose of PBL is to learn content, process skills, problem-solving skills, and learn in the wider life of the future. In the face of the challenges of the 21st-century teachers should prepare students to be capable of being a researcher, critical, and creative (Barell, 2010; Firdaus, Kailani, Bakar, & Bakry, 2015; Kassab et al., 2017).

The learning stages of the PBL include: (1) Integrating students to the problem (2) Organizing students to learn (3) Guiding the investigation (4) Developing and presenting the work, and (5) Analyzing and evaluating the problem-solving process (Arends, 2012; Strobel & Barneveld, 2009). These stages allow students to find out, read many libraries so as to build student knowledge.

Some teachers, researchers, and experts have tried to implement the PBL in the learning they do in the classroom. In the context of learning in Indonesia, at the JHS level, several studies have been done. Based on the various research results it is found that PBL can improve the quality of learning at JHS level (Andini, Susanto, & Hobri, 2017; Karyatin, 2016). PBL improves the students' skills in putting the mind map of the level well enough in all aspects to good level (Karyatin, 2016) and improving thinking ability (Fatimah & Widiyatmoko, 2014; A. T. Susanti et al., 2015), improving cognitive, affective, and psychomotor (Fatimah & Widiyatmoko, 2014; Fauzan et al., 2017; Mashinta et al., 2015; Novika, 2014). PBL also improves the ability of mathematical problem solving (Amalia, Surya, & Syahputra, 2017; Saragih & Habeahan, 2014), improves the ability of mathematical communication and social skills (Aufa, Saragih, & Minarni, 2016), and students' mathematical literacy (Indah, Mania, & Nursalam, 2016). PBL contribute well to improving aspects of science literacy attitudes (Hartati, 2016).

Some Class Action Research (CAR) and quasi-experiment themed PBL and related to science or biology have been done but at the level of high school and college education. Some of them, for example, are about PBL and its relation to problem solving ability and students' cognitive learning outcomes (Fitri &

Ramdiah, 2017; Noviar & Hastuti, 2015; Supiandi & Julung, 2016), the influence of PBL on the learning outcomes of circulatory system materials (Prilyta, Susanti, & Santoso, 2016), the influence of PBL on the learning result of mushroom concept (Rubiah, 2016), the influence of problem-based learning model on students' literacy ability on reaction rate material (Fitriani, Milama, & Irwandi, 2017).

Some researchers have tried to conduct research on PBL on social subjects in high school level, namely related to PBL implementation to improve student learning outcomes on sociology subjects (Hajar, Darmono, & Budiati, 2016; D. Susanti, 2013). While there is also research on PBL and its relation with biology and mathematics material and students 'thinking ability in university, that is about the influence of PBL on critical thinking and creative thinking skills of mathematics students (Rosa & Pujiati, 2016), PBL on students' metacognitive (Danial, 2010), PBL on the competence of biology students (Apriana & Anwar, 2014; Miharja, Syamsuri, & Saptasari, 2015). However, there is still a need for research on PBL in relation to the improvement of creative thinking skills, problem-solving skills, and learning outcomes in the context of CAR. Most previous researches are in the form of quasi-experiments and certainly have different characteristics, implemented in mathematics and social subjects, and have a different focus. There is no CAR study, on science subjects, at JHS level, and focuses on these three aspects: creative thinking skills, problem-solving skills, and learning outcomes. Therefore, based on various logical reasons that are in line with the various literature, this research/study needs to be done and has the value of novelty and benefits.

The aims of this study is to find out how the application of PBL can improve creative thinking skills, problem-solving skills, and students' learning outcome. Based on the description, a CAR needs to be conducted to figure out whether the application of PBL can improve those skills, as well as broaden the knowledge of students in seventh grade at SJHS 18 of Malang.

METHOD

The type of research used was CAR. The subjects of the study were 31 seventh grade students at SJHS 18 of Malang in the first semester of the academic year 2017-2018. There were three observers in this CAR. The study was conducted from October until December 2017. The study was conducted in two cycles, consisting of 14 meetings. The first cycle studied temperature, and the second learned energy. Each cycle consisted of seven meetings. In each cycle, the class action research has four main stages: planning, implementation, observation, and lastly, reflection, referring to Spiral Model by Kemmis, McTaggart, and Nixon (2014).

The planning stage is done before the action research, which includes: (1) Designing the syllabus; (2) Preparing the learning implementation plan with the application of PBL model; (3) Preparing phenomena in the form of pictures, videos, or experiments (4) creating student worksheets; (5) Creating an observation sheet for the implementation of the PBL; (6) Designing a rubric for measuring creative thinking skills and problem-solving skills, and (7) Designing pointers for an essay test and the scoring rubric.

The second and third stage consists of two main activities, namely the implementation and observation activities. The application of learning is done in accordance with the lesson plan that has been prepared. Observational activities are conducted by a teacher and other three observers. The lesson plan includes: (1) Preliminary activities covering the phenomena in everyday life, questions to explore the initial knowledge of students, and the delivery of learning objectives; (2) The core activities covering the learning stages of the PBL; and (3) Closing activities that consist of a review of the group outcomes and the learning conclusions.

The fourth stage was a reflection by the teacher and student-observer. The two analyzed the learning process that had been implemented and discussed the constraints that occurred during the learning process and the potential solutions. The observer provided her input. The results of analysis and discussion are used to improve the implementation of the learning process in the next cycle. The data obtained during the first cycle is also used as a reference to make improvements in the upcoming cycle.

The instruments in this study are described in Table 1. The creative thinking skills and problem-solving skills rubrics was referred to (Rhodes, 2009). The measured aspects of knowledge are memory, understanding, application, analysis, evaluation, and creation.

Table 1. Specification of instruments used in research

No.	Variable	Instrument	Data retrieval technique
1	Creative thinking skills	Rubric (Rhodes, 2009)	Student worksheet
2	Problem-solving skills	Rubric (Rhodes, 2009)	Student worksheet
3	Learning outcomes	Test	Writing test

The data were analyzed qualitatively and quantitatively using a descriptive method. Descriptive-qualitative method of analysis used was the one proposed by Miles, Huberman, and Saldana (2014) that includes: (1) data reduction; (2) systematic and logical descriptive presentation; and (3) making conclusions based on the presented results. Quantitative analysis is done by scoring observational data and calculating the average scores.

Data analysis was carried out from the beginning to the end of the data collection activities. The collected data were processed and analyzed qualitatively. Therefore, comparative descriptive technique and critical analysis were applied. The comparative descriptive technique was used for quantitative data particularly by comparing the results of each cycle. The data were in the form of scores obtained from the first and second cycles, presented in tables and analyzed using descriptive comparative analysis. The data could be read descriptively; therefore, critical analysis was used to reveal the weaknesses and strengths of the performance in the learning process (Husamah & Pantiwati, 2014).

RESULT AND DISCUSSION

PBL on students' creative thinking skills

The results of the average score and completion rate on each skill aspect can be seen in Table 2. The completion rate in Cycle 1 and Cycle 2 is 100% and improvement completion rate are 0-35% (average = 17.5%). Aspects that students find most difficult were making linking, synthesizing, and transforming (79.23% to 86.78%).

Table 2. Score and proficiency in creative thinking skill

Skills	Cycle 1 score	Cycle 1 completion (%)	Cycle 2 score	Cycle 2 completion rate (%)	Improvement score (%)	Improvement completion rate (%)
Ability to figure out problem-solving strategies	82.80	100	95.24	100	15	0
Developing problem-solving strategies	94.73	100	100	100	6	0
Integrating several different alternatives	81.29	74	92.34	100	14	35
Proposing new or unique things (ideas, claims, questions, etc.)	88.07	87	97.31	100	10	15
Linking, synthesizing and transforming	79.23	87	86.78	100	10	15
Average	85.22	100	94.33	100	11	17.50

Students need habituation in order to have the ability in solving out problems that they encounter. Such habituation is expected to help them improve their skills. Acquired skills are applied to face real-life situations. One of the skills essential in settling out problems is the creative thinking skill. Creativity is one of the markers of humanity. Wulandari, Sjarkawi, and Damris (2011) state that thinking skills are necessary for problem-solving. Furthermore, creative thinking is the mental process that individuals use to generate new ideas.

The creative thinking skills in this study are measured by one's ability to define problem-solving strategies, develop problem-solving designs, integrate different alternatives, propose new or unique things (ideas, claims, questions, etc.), and connect, synthesize and transform ideas. These facets are expected to allow students to think creatively. Teachers have a stake in the application of the PBL. Teachers are to motivate by raising questions and guiding the investigation. Kassab et al. (2017) state that teachers are needed as tutors who can play a role to facilitate the learning process by asking questions and monitoring the process of problem-solving. Therefore, Strobel and Barneveld (2009) saw the PBL as an ideal learning approach in which teachers help students determine the problems.

The data show that the implementation of PBL can advance students' creative thinking skills. Such a conclusion is reached, among others, by a study conducted by Ulger (2018) suggesting that the PBL can help students in solving problems and improving their creative thinking.

Thus far, it has been known that the stages incorporated within the PBL method are able to help students improve their creative thinking ability. Creative thinking is a thinking process characterized by fluency, flexibility, originality, and elaboration. Fluency is the ability to express ideas clearly. Flexibility is the ability to generate a variety of ideas from different standpoints. Originality is the ability to offer unique or unusual ideas, different from those in books or peculiar from the opinions of others. Elaboration is the ability to explain the influencing factors and to add detail to the ideas at hand as to make them much more valuable (Firdaus et al., 2015; Surya & Syahputra, 2017).

PBL on students' problem-solving skills

The average scores and completion rate in problem-solving skills are presented in Table 3. The improvement completion rate were 0-73% (average = 47%). The difficult aspect that students found was to explain the advantages and disadvantages of the attempted problem-solving (71.29% to 99.75%).

Table 3. Score and completion of problem-solving skills

Skills	Cycle 1 score	Cycle 1 completion (%)	Cycle 2 score	Cycle 2 completion rate (%)	Improvement score (%)	Improvement completion rate (%)
Formulating problems	82.70	100	98.21	100	19	0
Developing problem-solving strategies	77.83	48	87.69	83	13	73
Proposing a hypothesis for solving problems	83.29	100	98.02	100	18	0
Explaining the advantages and disadvantages of attempting problem-solving	71.29	81	91.46	100	28	23
Average	78.78	68	99.75	100	27	47

Problem-solving is a stage in which students exert their skills to find answers to problems (Amalia et al., 2017; Lucenario et al., 2016; Winarso, 2014). This phase will; (1) develop students' skills in solving problems (2) hone students' skills in solving problems; and (3) improve students' thinking skills. The PBL method can train students to develop and explore problems by raising awareness of different ways of thinking and resolving problems (Baysal, 2017).

The data show that PBL can improve students' knowledge, both in terms of problem-solving skills. In Phungsuk et al. (2017) study, PBL is also an active way for students to learn basic problem-solving skills and acquire knowledge through interaction with others, a key skill demanded by nearly every work environment. Schettino (2016) states that the PBL method can create a conducive learning environment and encourage optimal learning. The same view espoused by Supiandi and

Julung (2016) arguing that the implementation of PBL has consistently proven its success in improving students' ability to solve problems.

PBL encourages teachers to constantly train students in logical and analytical thinking to solve problems, in accordance with the construction of the subjects taught. Teachers create challenging learning situations and motivate students' curiosity to find their own answers (Karyatin, 2016). PBLs allow students to conduct an in-depth study of materials and issues, integrate theory and practice, and apply different knowledge and skills to develop solutions to problems provided by teachers (Amalia et al., 2017; Andini et al., 2017; Hajar et al., 2016; Horpyniuk, 2015).

PBL on students' learning outcomes

The average data score and learning completion rate can be seen in Table 4.

Table 4. Average score and completion of learning outcomes

Cycle	Score	Completion Rate (%)	Improvement score (%)	Improvement completion rate (%)
1	83.45	87		
2	94.70	100	13	15

There was 13% increase in score and 15% improvement completion rate. This shows that PBL can improve students' learning outcomes in science subjects. This means that PBL has procedures that allow students to enhance their skills and knowledge. In their research, Rosa and Pujiati (2016) suggested that the students taught using the PBL method possess a better critical and creative thinking ability. PBL help students cultivate their thinking competence and problem-solving skills so that they can become independent learners.

PBL has consistently improved students' learning outcomes (cognitive). The students' learning outcomes are improved because PBL promotes students how to apply their knowledge in real life situations (Supiandi & Julung, 2016). The implementation of PBL consistently will encourage the improvement of student learning outcomes. This is because PBL has systematic and structured steps, namely student orientation on the problem, organize students to learn, guide individual/group experiences, develop and present the work, and analyze and evaluate the problem-solving process (Okayana, 2016). PBL is almost always student-centered. So, these principles offer the opportunities to actively process information, trigger prior knowledge, have a meaningful content, and research and organize information (Sendag & Odabasi, 2009).

The first stage in PBL was introducing students to the given problems. Arends (2012) state that the formulation of the problems was designed by the students themselves, based on what they want to know. This is useful for exploring their own curiosity, motivating them to find the answers, and developing their thought processes. Problems were formulated in order to build their knowledge, establish higher levels of inquiry and skills, and improve their independence and confidence.

This CAR finding was PBL as really an implementation form of constructivism theory. PBL encourages students to construct their own knowledge through real problems that require a problem-solving. According to constructivism theory, Hajar et al. (2016) state that when students engage in discussion activities conducted at each cycle, they will exchange opinions and information, so that the concept of the material can be found by students. This research has also become a "booster" for teachers to implement PBL in their classrooms because it has been very clear that the results of the study support various literature, which has been widely described before. PBL positively influence learning outcomes along with learners' higher-order thinking skills such as creative thinking, problem-solving, logical thinking and decision making. PBL provides students with improved strategies to help them deal with very complex situations in their life.

CONCLUSIONS

The conclusion shows that the application of PBL improves (1) the average of creative thinking skill was 11% and the completion rate of 17.5%; (2) the average of problem-solving skills knowledge was 27% and the completion of 47%; and (3) the average score of learning outcomes was 3% and the completion rate was 15%. PBL can be implemented by teachers to improve student creative thinking skills, problem-solving skills, and learning outcomes.

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