Skill Analysis of Students’ Creative Thinking In Implementation Of Problem Based Learning With Plastic Waste Handling Context

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Abstract: The objective of this research is analysing the implementation of problem based learning (PBL) towards students’ creative thinking ability in plastic waste handling context. According to the rules of High School Competency Standard, students must have critical thinking skills, creative, innovative and be able to collaborate and communicate. One of the competencies that will be developed is the ability to think creatively which includes: the ability to think smoothly, flexibility, originality, elaborative and evaluative in plastic waste handling context. The research method was descriptive qualitative research. The subjects of this research were 65 students consisting of 2 classes of Grade X which are X IPA 2 and X IPA 3 in SMAN 1 North Tambun Bekasi Regency in year lesson 2017/2018. The instruments used in this study included written test, observation sheet, student work sheet, questionnaire and interview guideline. The data results were obtained from Pretest and Posttest and being processed and analysed using N-Gain. The creative thinking skill has improved with N-Gain 0.64 which is in the medium category, it shows that ability of mastery of concepts and skills of creative thinking can be developed through PBL.

1. Introduction
Learning is a set of actions designed to support the learning process of students. According to the National Education System Act (UUSPN) No. 20 of 2003[1], learning is the process of students’ interaction with educators and learning resources in a learning environment. A learning will be success when a positive behavior changes occur in students in accordance with objective learning plan. In the revised 2013 curriculum, the competencies required to improve the skills and abilities that can be applied to face the challenges of life in the 21st century.
Competencies to be achieved by students after graduating secondary education must acquire skills to live with a positive attitude with creative and critical thinking, communicative, and collaborative with honesty and openness based on the potential processes and products of science. Chemistry as a part of natural science is gained and developed on the basis of experiments in seeking answers to the question of what, why,
and how natural phenomena especially relating to the composition, structure, properties, transformation, dynamics and energy of matter. Chemistry as a process or method of investigation involves thinking, reasoning, formulating problems, conducting experiments and observations, analyzing data and concluding to obtain products [2], [3].

In the framework of mastery of 21st century skills of chemistry in high school regarded not only for the transfer of knowledge and skills (transfer of knowledge and skills) students, but also establish a high-level thinking skills (analysis, synthesis, critical, creative and innovative) through scientific work. Knowledge, skills, ability to think and act on chemistry learning will equip students for living in the community [4].

In relation to the above, it is necessary to strive for a learning that is able to activate the ability of students, especially those which related to life skills of the 21st century that one of them is the creative thinking skills in chemistry learning, especially in terms of solving a real problem in everyday life. In the 2013 curriculum, the highlight of instructional models are the activity and creativity, inspiring, fun and initiate, student-centered, authentic, contextual and meaningful learning, among others: Problem Based Learning Model. According to Tan [5], Problem-based learning is a learning innovation since the thinking skills of students truly optimized through group work or team systematically, so that students can empower hone, test, and develop the ability to think continually.

The learning strategy with PBL is expected to hone the creative thinking ability of students in chemical learning that is related to daily life, especially in the case of handling of plastic waste. Nowadays plastic waste becomes the main problem because of the increasing number of people, activation of life pattern, social and economic level and technological progress. Therefore, one of the environmental damage has become a major problem of plastic waste [6]. This research will be conducted to analyze the implementation of PBL in students creative thinking ability in plastic waste handling context. Creative thinking skills include: the ability to think smoothly, flexibility, originality, elaborative and evaluative [7]. Table 1 shows the indicators of achievement for the creative thinking skills.

Table 1. Aspects of creative thinking.

| No | Aspects of creative thinking     | Indicators                                               |
|----|----------------------------------|----------------------------------------------------------|
| 1  | Well-thinking                    | Ask a lot of questions                                   |
| 2  | Elaborative thinking             | Able to develop and explain in detail about the idea     |
| 3  | Flexible thinking                | Reveal many ideas about a problem                        |
| 4  | Original thinking                | Give consideration based on his own point of view        |
| 5  | Evaluative thinking              | Have a rationale in a decision taken                     |

(Munandar [8])

The PBL phase consists of five stages: Stage 1: Organizing students to the problem, Stage 2: Organizing students to learn, Phase 3: Guiding independent inquiry and group. Phase 4: Developing and presenting the works and exhibitions, stage 5: Analyzing and evaluating the problem-solving process [9].

2. Method

The method used in this research was qualitative descriptive research. According Sukardi ([10]: 163) descriptive research was a research method that describe the object or subject in carefully in accordance with what is with the aim to describe the systematic facts and characteristics of the object studied appropriately. This research was conducted at SMAN 1 North Tambun of Bekasi Regency in class X, those are X IPA 2 and X IPA 3. The number of students will be classified to high, medium and low group based on the chemistry daily score. Data collection techniques were test and non-test techniques. The instruments used in this study include written test, observation sheet, student work sheet,
questionnaire and interview guideline. The results of this study were obtained from pretest and posttest and being processed and analyzed using N-Gain and SPSS formula.

3. Results and Discussion

At the beginning of PBL, students made direct observations to garbage dumps in groups so the students can actually found problems about plastic waste. Students propose questions about plastic waste written on the work sheet prepared. Those questions will be the basis to formulate a problem that will be solved through group discussion. The next step was organize students to learn and guide independent and group investigations. At this stage, students were conduct a group discussions and trace the information to complete the formulation of predetermined problems. The last stage of PBL was present the work in the form of ideas about plastic waste containers. Then, the problem-solving process will be analyzed.

Although the learning activities were conducted in groups, the assessment was done individually through pre-test and post-test of improvement of students creative thinking ability. Differences in pre-test and post-test values of students measured by N-Gain with the criteria of increasing the score of N-Gain as follows:

| N-Gain Score | Interpretation |
|--------------|----------------|
| $( \langle g \rangle ) > 0.7$ | High |
| $0.3 < ( \langle g \rangle ) < 0.7$ | Medium |
| $( \langle g \rangle ) \leq 0.3$ | Low |

Table 3 shows the average score of students pre-test and post-test for creative thinking skills.

| No | Creativity | Average | N-Gain |
|----|------------|---------|--------|
| 1  | Creative Thinking | 28.0 | 69.1 | 0.64 |

Based on Table 3 and the criteria for increasing the score of N-Gain shows that the students’ thinking skills have improved after the implementation of problem based learning. The increase was categorized as a moderate increase, indicated in the N-Gain of 0.64. Regarding the creative thinking ability of our students will discuss in more detail as follows:

3.1 Generally Creative Thinking

The overall creative thinking skill has improved with N-Gain 0.64 which was in the medium category. This can be seen from the following figure:

![Figure 1. N-Gain the ability of Creative Thinking in its entirety.](image)

In the figure, the overall creative thinking skill has improved significantly.

3.2 Creative thinking by Group Category
Complex thinking is called high-level thinking consisting of critical thinking, creative thinking, problem solving and decision making (Tanwil [11]). So, creative thinking is similar with high-level thinking and problem-solving process. Based on the category of creative thinking, the improvement in high group is bigger than medium and low groups. This is due to the mastery of the concept in the high group is stronger than the medium and low groups. This is shown in the following figure:

![Figure 2. Creative thinking by Group Category.](image)

### 3.3 Creative thinking by Indicators

The creative thinking skills of students based on the indicators were measured by the average value of creative thinking ability on the average of pre-test and post-test and N-Gain values on handling of plastic waste, it can be seen in figure 3.

![Figure 3. The average of pretest, posttest and N-Gain based on indicators of creative thinking.](image)

Based on the value of N-gain in each indicator of creative thinking, it has increased especially in the ability to think smoothly that is the ability of learners to ask questions with N-gain value is 0.67. Whereas in the ability to think flexibility is to reveal the idea of a problem has the lowest N-gain. This was because there are still many ideas and those were not original, it can be seen in the ability of original thinking that has a value of N-gain above slightly from the ability to think flexibility of 0.55. Nevertheless, overall
creative thinking skills have improved on each indicator based on N-gain value in the medium category.

4. Conclusion
Based on the results, it can be concluded that problem-based learning can improve the ability of creative thinking. PBL can be recommended and applied to the learning process of chemistry that has suitability characteristics between learning materials with PBL stages.

5. References
[1] Permendiknas RI UU No. 20 2003 Sistem Pendidikan Nasional (Jakarta: Menteri Pendidikan Nasional)
[2] Permendikbud No. 20 2016 tentang Standar Kompetensi lulusan (Jakarta: Kementrian pendidikan dan kebudayaan)
[3] Permendikbud No. 21 2016 tentang Standar Isi (Jakarta: Kementrian Pendidikan dan kebudayaan)
[4] BSNP 2010 Paradigma Pendidikan Adad XXI (Jakarta: Departemen Pendidikan Nasional)
[5] Tan, O S 2003 Problem-based Learning Innovation : Using Problems to Power Learning in 21 Century (Singapore: Thomson Learning)
[6] Setyowati 2013 Pengetahuan dan prilaku ibu rumah tangga dalam pengelolaan sampah plastik Jurnal Kesehatan masyarakat Nasional Vol.7 no 12 pp 562-6
[7] Wahyu W, dkk 2015 Using Problem Based Learning to Improve Students’ Creative Thinking Skills on Water Purification Proceeding of International seminar on Mathematics, Science and Computer Science Education (MSCEIS 2015)
[8] Munandar, U 2012 Pengembangan Kreativitas Anak Berbakat (Jakarta: Rineka Cipta)
[9] Rusmono 2012 Startegi Pembelajaran dengan Problem Based Learning (Jakarta: Ghalia Indonesia)
[10] Sukardi 2003 Metodologi Penelitian Pendidikan (Yogyakarta: Bumi Aksara)