

IMPLEMENTATION OF PROBLEM SOLVING MODEL TO TRAIN STUDENTS CREATIVE THINKING SKILL

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Abstrak Penelitian ini bertujuan untuk mengetahui keterlaksanaan model pembelajaran *problem solving* dalam melatih keterampilan berpikir kreatif siswa. Subyek penelitian ini adalah siswa kelas XI IPA 6 di SMA Negeri 1 Sidoarjo. Jenis penelitian yang digunakan adalah praeksperimen dengan desain penelitian pretes postes kelompok tunggal. Teknik pengumpulan datanya menggunakan metode tes untuk mengetahui tingkat keterampilan berpikir kreatif siswa. Hasil penelitian menunjukkan bahwa melalui pembelajaran *problem solving* keterampilan berpikir kreatif siswa secara klasikal meningkat dengan kategori sedang dengan nilai gain sebesar 0,3.

Kata kunci: Problem Solving, Berpikir Kreatif, Kelarutan dan Hasil Kali Kelarutan.

Abstract The aim of this research is to know the implementation of problem solving model to train student's creative thinking skill. This research subject is the sixth class of science grade XI in Senior High School 1 Sidoarjo. Type of this research is pre experiment with one group pretest-posttest design. Technique that is used to collect data is test method to measure creative thinking skill level. The result of this research shows that problem solving model can improve creative thinking skill in medium category with the gain score is 0,3.

Keyword: problem solving, creative thinking, solubility product

INTRODUCTION

Badan Standar Nasional Pendidikan (BSNP) explain that Pancasila and the state constitution have explained about the fuction of education, it is to develop skills and built behavior of national attitude in the case of raising intellectual life of nation , to develop students potential in order to be faithful human, noble, healthy, knowledgeable, competent, creative, independent, and become citizens of a democratic and accountable [1].

BSNP explain that science and technology group aims to acquire basic competence in science and technology as well as cultivate scientific thinking, critical, creative, and independent [1]

One of the subject matter in chemistry is the solubility and solubility product.. Based on the standard of competency to be achieved, it is expected that students can understand the properties of acid-base, methods of measurement, and the application. Basic competencies to be

achieved is to predict the formation of the precipitate from a reaction based on the principle of solubility and solubility product.

Based on interviews with a chemistry teacher at SMAN 1 Sidoarjo on 25 November 2011 with Masrutji Handajani, S.Pd, M.Si, solubility and solubility product is a difficult material. Students are often confused in deciding what steps to take in resolving the questions. This is reinforced by the number of students in grade XI who got the learning outcomes over KKM value (values obtained ≥ 76) is 55%. Classical learning is completed when the percentage of students who completed $\geq 85\%$. The percentage of completeness in learning with the material solubility and solubility product is still far from the expected and need to take appropriate learning models to overcome it.

Learning models that are used in solubility and solubility product material are direct learning and cooperative

learning, with the percentage are 25% and 75%. Those lecture methods dominate because it is considered the most effective method to explain the concept of solubility and solubility product of which, according to teachers is an elusive matter. Practical activities carried out to prove the occurrence of precipitation when the two substances reacted and decreased solubility is influenced by pH and common ion

Obstacles often experienced by students in the study the material solubility and solubility product of solving problems is a matter that affects the learning outcomes obtained.

Opinions of teachers about students' difficulties in understanding the matter in accordance with the results of student questionnaires given to students, where 80% of students in class XI IPA 6 states the difficulty in working out the problems in learning chemistry.

To find out about the difficulties experienced by students, was given a three-choice questions with answers and students are allowed to select more than one answer choice. The result, 44% of students in class XI IPA 6 said it was difficult to understand the words to identify the problems in question, 40% of students in class XI IPA 6 was difficult to determine the steps to be performed, and 55% of students in class XI IPA 6 confused with the application formula in question.

Questions about how often solve problems with more than one way is given to students to see the general picture of students' creative thinking abilities. As many as 80% said sometimes, respectively each 10% to often and never. Students creative thinking in general is most students are quite creative, but there are still problems in the solutions.

According to Siswono, learning problem solving models are expected to train students to be skilled in solving problems and solve them independently in [2].

Problem solving is a process or the attempts of individuals to respond to or overcome barriers or obstacles when an answer or a method needed to find. This

lack of clarity and will make uncomfortable condition and demanding a settlement. Students are trained to think of removing his ideas in order to use the things he knows to solve the problem. Questions which can easily answered or be known by just insert the numbers in the formula that is available does not include categories of problems.

There are steps that help students to get used to solve problems in the learning model of problem solving. These are understanding the problem), devising a plan, carrying out the plan, and looking back [2]. A series of steps would be easier for students to be able to solve problems independently.

According to Plucker, complex problems in daily life require creative solutions. Creativity is crucial to the success of psychological, physical, social, and individual career [3]. Creativity itself according to Berk is the ability to produce original work, but still effective and beneficial relationship can be drawn between problem solving and creativity [3].

Creativity is the thinking of imaginative and original problem solving. Provision of problem solving questions can simultaneously hone students' skills and creative thinking can help students to better understand the concepts being studied.

The author seeks to apply the learning model of problem solving that give problems are ill-structured (not structured properly) that requires creativity in problem solving.

Problem solving is usually defined as formulating an answer that is more than just a simple application of the rules that have been previously studied to achieve the goal [3]. There is a link between creative thinking and problem solving.

Association can be seen from some definitions of creative thinking abilities. For example, Hwang et al defines the ability to think creatively as cognitive skills to provide solutions to a problem or make something useful or something new from the norm [4].

Silver explained that creative thinking is often considered to consist of three elements, namely fluency, flexibility, and novelty. Fluency (smoothness) is a skill to be able to generate new ideas or answers even in the same context. Ideas or answers are not only many, but also useful and appropriate. Flexibility (flexibility) is a person's skills to be able to think through the various points of view, reference, and approaches. As a result, there arose a variety of solutions to its kind. Novelty (newness) is the uniqueness of an idea. Unique here is that new ideas. The new question should not really exist or has not been well for others. But the question is a new idea had never occurred previously obtained [5].

METHODS

Pre experiment design used is the design of single-group pretest-postes is a group that is subject to certain treatment in the absence of a comparison group. Pretest and postes given to students to know the experimental results. The research was conducted in SMA Negeri 1 Sidoarjo by taking a class XI IPA 6 as a sample. with the acquisition of the determination of the sample is not randomly determined, namely through convenience sampling.

Pretest and postes given to students then measured the ability to think creatively. Creative thinking ability was measured with a special section of creative thinking skills developed by Siswono [2].

The results of the pretest and postes showed levels of students' creative thinking skills. Increased levels of the students at the time of the pretest and postes gain scores are calculated to determine the increase in creative thinking. Gain value and then categorized into three, namely an increase in the low category $<g>$ value <0.3 , the increase in the medium category with $0.3 \leq <g> \leq 0.7$, and increased with higher categories with $<g> \geq 0.7$.

The formula to calculate the gain according to Hake is as follows [6]:

$$<g> = \frac{\text{postscore\%} - \text{prescore\%}}{100\% - \text{prescore\%}}$$

note:

$<g>$ = the normalized gain
% = Percentage of the postes postscore
% = Percentage of the value of the pretest prescore

Creative thinking skills are categorized into five levels, among which are not creative (level 0), less creative (level 1), quite creative (level 2), creative (level 3), and very creative (level 4). Study skills of creative thinking skills is determined through the student's ability to show three things to solve the problem, namely fluency, flexibility, and novelty.

Students at level 4 are able to solve a problem with more than one alternative answer or solution with novel and flexible.

Students at level 3 are able to make a new answer but can not develop in different ways (flexible) to get it or the students can develop in different ways (flexible) to obtain a variety of responses, although the response is not new. Students tend to say that looking for other ways more difficult than the search for other answers.

Students at level 2 are able to make a response even if not flexible or smooth, or students are able to prepare a different resolution, although not fluent in the answer.

Students at level 1 is able to answer a variety of problems (fluent), but was unable to make a different answer (new), and can not resolve the problem in a way different (flexible).

Students at level 0 was unable to make alternative answer or a different way of resolving the smooth and flexible. Errors due to the completion of a problem related to the concept of the issue is not properly understood or remembered [2].

RESULT AND DISCUSSION

Filing Siswono formulate a model of learning and problem solving (Jucama) which was later adopted in this study. Learning model is derived from assessments on measures of problem solving that is expressed by several previous investigators.

Polya describes the steps of problem solving in general, namely to understanding the problem, devising a plan, carrying out the plan, and looking back [2]. The move will occupy the core activities of learning models syntax joining Jucama submission step in the research

problem, but just concentrate on problem solving.

Based on the measures contained in the application and problem solving, the problem solving model of the syntax defined in this following table:

Table 1 Syntax of Problem Solving Model

Phase	Teacher Activity
Explain the learning goals	Explain goal, previous matter, motivate student, , and hook the matter with daily life
Orient student to problem and	Give problem appropriate to the development level of student. Ask the student to solve the problem by work together in group
Guide student to solve the problem	Teacher guide and orient student effectively
Present problem solving result	Teacher help student to decide the group who have chance to present the result
Check the understanding	Check the ability of student

Learning problem solving carried out at three meetings. Students learn about the effects of one ion at a meeting of its namesake, the effect of pH on the solubility of the second meeting, and precipitation reactions at the meeting 3.

Solubility and solubility product material has previously been taught by the teacher. Further back are taught through a learning model of problem solving to enhance students' creative thinking skills. This is consistent explanation by Mahmoodi, that in the context of mathematical learning, problem solving is often used as a stage of the application of a concept [7].

In addition, Problem solving is usually defined as formulating an answer is more than just a simple application of the rules that have been previously studied to achieve the goal [3].

The first phase of the learning model of problem solving is to deliver the goals and prepare students. Teachers convey the learning objectives to students so that students know the expected output of the ongoing learning. It is continued with the delivery of learning models to be used in teaching and explaining the outline of the activities to be carried out in learning to prepare students

The second phase is to organize the problem through problem solving,

which is one of the core activities. Teachers guide students to form groups and share worksheets in each group. Herrmann explained that the learning is organized in small groups beneficial for the growth of thinking and different skills and prevent stagnation of ideas [8].

Group discussion activities also help accelerate the emergence of ideas. Bejjani explain that brainstorming in small groups with a maximum membership of twelve men to grow a lot of ideas in a short time [9].

Creative thinking skills students are expected to grow through the activities of the group discussion with a friend. The weakness of this activity is the possibility of a focus group of students who did not participate in the resolution of problems so that their creative thinking skills have not been trained properly

The next activity is to provide an example of how to solve the problem with a lot of answers (fluency), through a different viewpoint (flexibility), as well as meet the newness (novelty).

The first step is to understand the problems in which students are asked to read the problem and express it in a question form. In the next stage students are asked to find information that can be used to answer questions.

Students are asked to express his ideas to solve the existing problems. At the

first meeting, students still tend to be confused to learn that is allowed to answer with more than one answer, but at the next meeting, the students are fluent in expressing his ideas.

The third phase is to guide the completion of an individual or group. In guiding problem solving, the teacher visited each group to solve problems and emphasized the criteria of problem solving.

The fourth phase is to present the results of problem solving. Activities undertaken by teachers at this stage is to ask students to communicate the results of their discussion and provide opportunities for other groups to give an opinion about the answer or other means of resolving

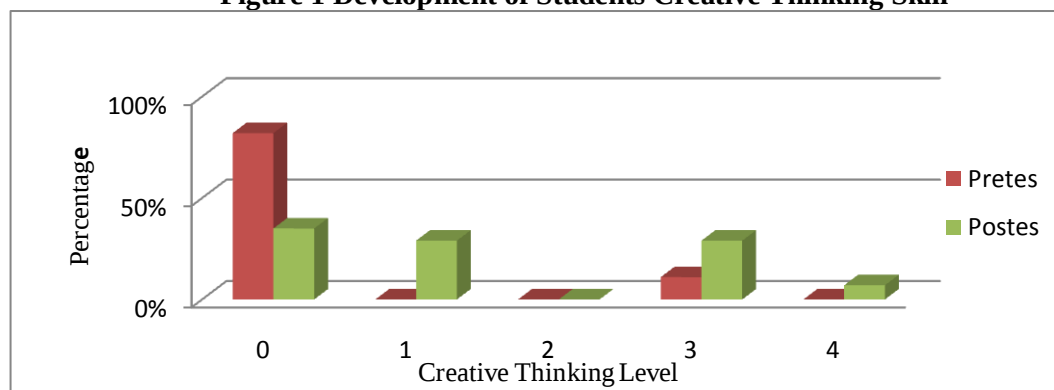
problems to demonstrate aspects of fluency, flexibility, and novelty.

Silver argues that the discussion groups are still unable to train effectively so that the flexibility of thinking required of presentation [5].

The fifth phase is to give feedback to students. teacher provides feedback to the students to apply problem solving that have been studied in further material and in everyday life. Teachers check students' answers to the presentation and emphasis on problem-solving way.

The increased levels of creative thinking skills of students through the learning model of problem solving in class XI IPA 6 SMAN 1 Sidoarjo, are as follows:

Figure 1 Development of Students Creative Thinking Skill



The number of students at level 0 level of creative thinking at the time of the pretest was 82%, while at the postes is 35%. Students at level 0 is not able to answer with a lot of answers when solving problems.

The number of students who have the skills to think creatively level 1 (less creative) before the study was 7%. After learning of problem solving to increase to 29%. Students at level 1 is able to answer the current problems, but are not able to make a different answer (new), and can not resolve the problem in a way different (flexible).

The answer is said to be different if the student can provide a combination of the answers given. For example, when asked to show some alternatives CaSO_4 way of making students only able to respond with the same type of reagent

substances, but only change the volume or concentration of substance, it can not be said to be flexible. If the student answers by changing two aspects, then the student can be said to think flexibly.

Creative thinking skills level 2 is not increased. Students at level 2 are able to make a response even if not flexible or smooth, but the answer meets the novelty. In the present study found students who are not able to answer with one answer, but by adding different things.

Creative thinking skills at level 3 increased from 11% to 29%. Students can develop in different ways (flexible) to obtain a variety of responses, although the answer is not "new". Students could give more than one answer at this level while meeting the flexibility.

Creative thinking skills level 4 which initially amounted to 0% to 7% of

all students. Creative thinking skills of students at level 4 are able to answer with a smooth, supple, and the new. Two students from 28 students that fulfill these criteria.

Answers given by students at this level is more than one answer, meet flexibility, and with how to answer that is different from the answers given by

students in general. The answer will be a new way to resolve problems.

Level of students' ability to think creatively and postes pretest results were then calculated using the formula increase <g> gain. Data enhancement of creative thinking abilities of students based on gain scores obtained are presented in Table 3 as follows:

Table 3 Data Acquisition Gain Score

Gain Score	0,0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0
Amount of Students	11	0	0	8	0	0	0	2	5	0	2

Based on data in Table 3, 14% of students gained an increase in the high category, 29% were categorized as students gain increased, and 57% of students gained an increase in the low category. An average increase of 0.3 in the classical style is included in the medium category.

CONCLUSION

Improved ability to think creatively in the classical style is at 0.3 which includes the category of being. Based on the above conclusions can be made several suggestions from authors such as: tests of creative thinking skills should be tested first so that the allocation of time granted in accordance with the amount of matter and the structure of the problem.

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