

# Application of Cooperative Problem-Based Learning Model to Develop Creativity and Foster Democracy, and Improve Student Learning Outcomes in Chemistry in High School

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## Abstract

Implementation of cooperative problem base learning models in developing creativity, democracy and improve student learning outcomes in chemistry have been conducted in this study. There are 132 students as research subject from 5 high school located in the province of North Sumatera. The study was conducted with a quasi-experimental approach. Instruments are standardized tests used to measure student learning outcomes, while the instrument is used to measure the development of students' creativity and democracy with the observation sheet with standardized indicators. The results showed that the Cooperative Problem Base Learning Model can significantly improve student learning outcomes of chemistry (sign. 0,000). In addition, this learning model can develop students' creativity and democracy to the effectiveness of 84.1 % and 86.4 % .

**Keywords** : Learning model, creativity, democracy, student learning outcome.

## 1. Introduction

At this time the Ministry of Education and Culture in Indonesia being intensively implement character education as set forth in Curriculum 2013. Implementation of Curriculum 2013 in Indonesia began in July 2013, ranging from elementary school to high school. Implementation of Curriculum 2013 in Indonesia requires a learning model that enables the students. Traditional learning model where learning is centered on the teacher, can no longer be used at this time. Therefore, in order that character education can be integrated in the implementation of the learning process takes an innovative learning model that enables the students.

Creativity and democracy is a very important character in improving the quality of education in Indonesia. Creativity is a character that is needed to give birth to new discoveries that are expected to boost the nation's progress. On the other hand, needed a harmonious social life and mutual respect between people with each other. Therefore, the growth of the character of democracy is needed in learning at school. The growth of democracy in students is necessary to maintain national unity.

Creativity is core of all competencies of your organization because creativity is what makes something better or new (Degraff and Khaterine, 2002). Creativity is one of the key factors that drive civilization forward (Hannessey and Amabile, 1987). Creativity provides the foundation for science, art, philosophy, and technology. The creative process involves the integration of several mental functions and also involves all the components of the life experience. Martinsen (1995) suggested that when students solve insight problems, which require students to "use an object in some unusual way to solve a problem." Problem restructuring is required to some extent. These researchers also questioned whether there is a specifics or a general transfer of skills after solving these types of problems. Martinsen suggested that cognitive styles might explain the transfer problem as well as the restructuring process involved in solving insight problems.

Torrance in Fasco (2001), the purpose of creative teaching is to create a "responsible environment" through high teacher enthusiasm, appreciation of individual difference, and so on. Davis (1991) also believed establishing a classroom environment conducive to creative thinking :

1. Support and reinforce unusual ideas and responses of students.
2. Use failure as a positive to help students realize errors and meet acceptable standards in a supportive atmosphere.
3. Adapt to student interests and ideas in the classroom whenever possible.
4. Allow time of students to think about and develop their creative ideas. Not all creativity occurs immediately and spontaneously.
5. Create a climate of mutual respect and acceptance between students and between students and teachers, so that students can share, develop, and learn together and from one another as well as independently.
6. Be aware of the many facets of creativity besides arts and crafts : verbal responses, written responses both in prose and poetic style, fiction and nonfiction form. Creativity enters all curricular areas and disciplines.
7. Encourage divergen learning activities. Be a resource provider and director.
8. Listen and laugh with students. A warm, supportive atmosphere provides freedom and security in

exploratory thinking.

9. Allow students to have choices and be a part of the decision-making process. Let them have a part in the control of their education and learning experiences.
10. Let everyone get involved, and demonstrate the value of involvement by supporting student ideas and solutions to problems and projects.

The word “democracy” has its origins in the Greek language. It combines two shorter words: “demos” meaning whole citizen living within a particular city-state and “kratos” meaning power or rule. However, both terms have more than one meaning (Arblaster, 1996). Writers such as Aristotle accept the definition of democracy as being ruled by the people or the many, including the poor. This was not necessarily the case in Ancient Greece, where the only participants were adult males who were eligible to serve in the defence forces. So a democratic state is one where government is legitimised by the agreement of those subject to its rule, agreement being determined through the election process. Elections are therefore the essence of democracy, referring to the procedural basis of the concept.

Although many nations promote the value of teaching for democracy, this crucial part of the student's lifelong education is rarely given sustained attention in the formal curriculum or the school community. Democracy should be viewed as key learning outcomes in the formal and informal curriculum from the earliest years of schooling. If there is to be government of the people, by the people and for the people, then there must be education of the people in the principles, practices and commitments of democracy (Patrick, 1996)

If democracy is to continue, our students must be taught to value democracy as a concept and a way of life. Teaching democracy also means preparing the students to be citizens who will take part in actively preserving democracy. We must teach about democracy so that students experience it themselves. If states are to have a capacity for active citizenship, then schools have a vital role to play in nurturing the moral and ethical development of young people and their capacity to participate in civic life. When addressing the question of “why teach democracy?” we need to reflect on the definition of democracy and confirm in our minds what we are actually striving to achieve. As educators, we need to have a firm conviction that democracy is possible, that the democratic way of life can be lived and that schools can and should bring democracy to life in the curriculum. When teaching democracy, teachers are developing skills and contributing to a society of enlightenment and understanding.

Teaching democracy involves a two-pronged approach. The basic concepts of democracy must be taught, providing children with the knowledge base and theories underpinning democracy and the democratic state. In order to teach democracy teachers must model democracy. Secondly, students and teachers must be free to experience democracy, to learn to function in it and to grow and change through the experience. It is important to remember that ideas don't become knowledge except by being embodied in practice and in consequent transformations of the self. There is no right way to teach democracy unless we practise it. Gutman (1987) agrees that curriculum documents alone cannot take total responsibility for citizenship. A school's ethos, its structures and its role models also clearly articulate to students about what is important and valued.

The question that arises is : "What kind of learning model that can develop creativity and foster the growth of democracy students, and to improve student learning outcomes in chemistry class in high school."

Cooperative Problem Base Learning Model is an innovative learning model that enables the students. This learning model is a combination of Problem Base Learning with the cooperative learning.

Cooperative problem-based learning model was developed by taking advantage of existing on problem-based learning model combined with the benefits inherent in the cooperative learning model. Problem-based learning model has several advantages such as students are challenged to be able to solve the problem at hand, so that all students' abilities both cognitive, affective, and psychomotor can thrive. In addition, students are trained to think in divergent thinking (Akinoglu and Tandogan, 2007; Tsankov, 2012; Fatokun and Fatokun, 2013). In cooperative learning model has many advantages such as increased sensitivity and social solidarity, build friendships and eliminate selfishness, develop social skills to maintain a relationship of mutual need, increasing penchant friends regardless of ability, gender, ethnicity, social class, and religion (Ward and Laslett, 2004 ; Macpherson, 2007; Olupide and Awokoy, 2010; Chritian and Pepple, 2012).

In the cooperative problem-based learning model, students are exposed to issues related to teaching materials. With the problems that must be solved in the process of learning the students' creativity will flourish. Furthermore, the problem solved by cooperative learning. Problem solving by way of cooperative learning, can improve the sensitivity and social solidarity, build friendships and eliminate selfishness, develop social skills to maintain a relationship of mutual need. Thus students can develop a sense of democracy.

Based on the above, the problem in this research can be formulated as follows :

1. Is cooperative problem-base learning model can significantly improve student learning outcomes in chemistry in High School?
2. Is cooperative problem-base learning model to develop student creativity?

3. Is cooperative problem-base learning model to foster the growth of student democracy?

## 2. Methods

### 1. Subjects and Study Sites

Subject of this study there were 132 students from 5 high schools in the province of North Sumatera. Research carried out by using a quasi-experimental approach.

### 2. Research Instruments

The instrument used in this study there are two kinds:

- a. Test is used to measure student learning outcomes. Test instruments in compliance validation and reliability standards.
- b. Development of students' creativity and democracy was observed with the observation sheet that has a standard indicator.

### 3. Research Procedures :

Research procedures performed in this study include :

1. Provide initial tests on students.
2. Provide learning to students with a cooperative problem base learning model.
3. At the time the learning takes place, is observed to grow students creativity and democracy.
4. Provide final tests on students.
5. Perform data collection, followed by data analysis.
6. Draw conclusions and report results.

### 4. Learning Steps in Cooperative Problem Base Learning Model.

The learning steps include:

1. Teachers express purpose of learning and motivate students.
2. Teachers deliver learning problems
3. Teacher organizes students into study groups.
4. Students work in groups to solve problems of learning.
5. Students present their work, followed by questions and answers.
6. Teachers work with students to discuss the results of the group and make inferences.
7. Teacher assessment and provide reward to students.

### 5. Data analysis

The success of cooperative problem-based learning model in improving student learning outcomes tested with Paired Sample T - Test at the  $\alpha = 0.05$ . Data analysis was calculated using SPSS.

Effectiveness of cooperative problem base learning model to develop creativity and foster the growth of democracy students were analyzed to determine mastery learning. Said to be complete if the value of students learning  $\geq 70.0$ .

The development of creativity and democracy students are assessed based on the value obtained by each student. There are 4 levels of competency are:

1. The first level with a very good predicate, with a score between 90 - 100.
2. The second level with a good predicate, with a value between 80 - 89.
3. The third level with sufficient predicate, with a value between 70 - 79.
4. The fourth level with predicate incompetent, with values  $< 70$ .

Students at the fourth level is declared incompetent. Students at the first level, the second level, and the third level are declared competent by a different predicate.

### 3. Results

Based on data from the pre test and post test results it can be seen whether the implementation of cooperative problem-based learning model can improve student learning outcomes of chemistry. Data were analyzed using Paired Sample T-Test, at the  $\alpha = 0.05$ . Data analysis was calculated using SPSS, and the results are presented in Table 1.

Table 1. Significant value of improving student learning outcomes after learning with cooperative problem-based learning model.

	Number of students	Mean	SD	Significant
Pre test	132	45,56	20,46	
Post test	132	73,52	14,3	0,000

In Table 1, the result of significant value is  $0.000 < 0.05$ , thus it can be concluded that the model of

cooperative problem-based learning can significantly improve student learning outcomes of chemistry.

By the time the class was taught with a cooperative problem-based learning model the development of creativity, and democratic students observed and recorded in the observation sheet. Each student is given a score that would be converted into value.

Based on the growing development of creativity values of 132 students, there are as many as 22.7 % received the title with excellent competence. There are as many as 43.2 % received the title with good competence, and 18.2 % received the title with sufficient competence, and as much as 15.9 % declared incompetent.

Based on the growing development of democratic values of 132 students, there are as many as 24.3 % received the title with excellent competence. There are as many as 43.9 % received the title with good competence, and 18.2 % received the title with sufficient competence, and as much as 13.6 % declared incompetent. Complete, the results are presented in Table 2.

Table 2. Percentage growth of creativity and democracy students

Competence Levels	Creativity (%)	Democracy (%)
Very Good	22,7	24,3
Good	43,2	43,9
Sufficient	18,2	18,2
Incompetent	15,9	13,6

Based on the research results are presented in Table 2, it can be concluded that the model of cooperative problem-based learning can effectively develop students' creativity and foster democracy students respectively 84.1% and 86.4%.

#### 4. Discussion

Based on the results obtained in this study prove that the model of cooperative problem-based learning is very significant to improve student learning outcomes ( sign. 0,000). In addition, cooperative problem-based learning model can effectively develop students' creativity and foster democracy students respectively 84.1% and 86.4%.

Results of this study indicate that cooperative problem-based learning model is very effective as an instructional model recommended to be applied in implementing character education. Hence, cooperative problem-based learning model is appropriate for use in the learning process based on the implementation of the curriculum 2013 in Indonesia.

Model of cooperative problem-based learning is an instructional model results combined with cooperative learning model using a problem-based approach (Yusof, et. al., 2011; Hamid and Abbas, 2012). This learning model in its execution begins with the teacher asking the purpose of learning and motivate students. Learning objectives need to be submitted by the teacher to the students clearly understand what competencies they have mastered during the learning process. Learning objectives were formulated teachers include cognitive, psychomotoric , and affective aspects. In addition, teachers need to motivate students so that students become interested in learning the subject matter presented. Various means can be used to motivate students, for example, linking with real-life subject matter that gives certain advantages to the students. The advantage could be material and non-material.

In the second step, the teacher dilever learning problems. Giving problem to the students is very important in the learning process. With the problems that must be solved by the students then they will be more creative. All students' ability to be deployed to solve these problems.

The scope and depth of learning problems are formulated teachers should be tailored to the characteristics of teaching materials the students will learn and the rate of growth of psychology students. Therefore, teachers must understand the characteristics of good teaching materials, and psychological development of students. In addition, the depth of the problem presented by the teacher must be able to support the basic competencies and core competencies as it has been formulated in the curriculum 2013.

In the third step, the teacher organizes students in the study group. Each study group consisted of 2-5 students with varying composition excellent views of academic achievement, gender, ethnicity, etc. Composition of the study group members can change to any discussion of new topic.

In the fourth step, students work in groups to solve problems of learning. At this step all students can devote all his ability to solve problems of learning. Teachers should provide students activity sheet that will guide the students to be able to resolve the problem of learning. The use of instructional media is very helpful in develop quality throughout the student's ability. At this step requires quite a long time. At this stage the growing development of students' creativity and democracy can be observed and assessed by the teacher. Therefore,

teachers should bring growth observation sheet to observe students' development of creativity and democracy.

In the fifth step, the students present their work, followed by his desk replied. Group of students who presented their work is solely responsible for the results that have been agreed upon and concluded the discussion group. Another group of students who may deny or question the results delivered. To present the group's work, all students take turns presenting their work, so that all group members participate fully responsible for the results obtained. At the fifth step, creativity and democracy students can be observed and assessed by the teacher.

In the sixth step, the teacher with the students to discuss the work of the group and make inferences. Conclusion learning outcomes should be formulated by the students under the guidance of teachers. Do not let teachers formulate their own conclusions without involving the participation of students. Student participation in formulating conclusions can enhance students' creativity and foster democracy.

In the seventh step, the teacher provides assessment and awards. Provision of assessment is intended to provide positive feedback to students that can be used by students to evaluate the level of exhaustion learning objectives. Awards were given to groups of students who best results. It is expected to motivate students to learn better in the future. The award can also create healthy competition between groups of students and between students with each other.

Overall, the time needed by the students to be active during the learning process will be much more than the teachers, so that the student-centered learning. Students are doing activities during the learning process, so that cognitive ability, psychomotor, and affective student can be honed and trained to the fullest. Trained on aspects of cognitive, affective and psychomotor students during the learning process, will cultivate students' creativity and democracy. In addition, the responsibility of the student can thrive during the learning process. Sensitivity and social solidarity will grow well. Sharpening of mutual cooperation, compassion and caring among students during the learning process can build friendship, mutual trust, improve penchant friends, and eliminating selfishness, and facilitate student social adjustment. There is a problem to be solved by the students during the learning process will encourage the development of students' creativity grow.

The scope and depth of learning problems designed by the teacher should be tailored to the characteristics of teaching material . For theoretical level teaching materials, learning problems will vary with material characteristics that are applicable, and different teaching materials for characteristics that are understanding the concept, as well as to the characteristics of different teaching materials that are abstract. Thus the learning problem presented by the teacher depends on the characteristics of the teaching materials are studied by students. Therefore, the main thing that must be understood by teachers in using this model of learning is the teacher must be able to accurately determine the characteristics of teaching materials that will be learned by the students.

The use of instructional media in the application of cooperative problem-based learning is necessary. Instructional media used can be either the real thing or a computer -based instructional media, or other media that are tailored to the characteristics of teaching materials, and the availability of facilities and infrastructure in schools. In conjunction with media learning, creativity and innovation required the teachers to use appropriate learning media adapted to the conditions existing schools.

Place with the implementation of cooperative problem-base learning model does not necessarily have a problem in the classroom. Be conducted in a place of learning outside the classroom. Implementation of learning outside the classroom can actually increase students' motivation. In addition, the implementation of learning outside the classroom can increase students' love and concern for the environment will be a problem.

Facilities and infrastructure necessary for the implementation of cooperative problem base learning model should use a seat/bench that can easily be repositioned. Thus the formation of discussion groups shorter time, so use the time to learn more effectively. In addition, to improve the quality of student learning during the discussion, the school must provide a complete internet that can be accessed by students at any time.

Completeness notebook or computer, preferably taken by the individual student, while the projector and completeness of internet access should be provided by the school. More complete supporting facilities and infrastructure owned by the student and the school, the more it will improve the quality of learning.

## 5. Conclusion

1. The cooperative problem-base learning model can significantly improve student learning outcomes in chemistry ( sign. 0,000 ).
2. The cooperative problem-base learning model to develop creativity with mastery learning effectiveness by 84.1 % . There is as much as 22.7 % at a very good level of competence ; 43.2% at the level of good competence ; 18.2 % at the level of sufficient competence , and as much as 15.9 % declared incompetent.
3. The cooperative problem-base learning model to foster democracy with mastery learning effectiveness

by 86.4 % . There is as much as 24.3 % at a very good level of competence ; 43.9% at the level of good competence ; 18.2 % at the level of sufficient competence , and as much as 13.6 % declared incompetent.

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