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The Effectiveness of Collaborative Creativity Learning Models (CCL) on Secondary Schools Scientific Creativity Skills

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This research aims to describe the effectiveness of collaborative creativity learning models to train student's scientific creativity learning outcome for secondary student. This research was conducted using one group pre- and post-test design. The results showed (1) an improved indicator of achievement in motion material with average g-score = 0.66 (medium) and in simple machines material with average g-score = 0.72 (high); (2) 97.9% of students gave responses that collaborative creativity models enabled them to practice scientific creative skills. The research showed that collaborative creativity models were effective in improving scientific creativity skills.

Keywords: model, collaborative creativity, scientific creativity, learning models, skills

INTRODUCTION

Development in science and technology is growing rapidly that spur us to improve human resources. Improvement of human resources required for the mastery of science and technology is largely determined by the mastery of science. Mastery of science can be pursued through improving the education quality and teaching science. Science is a study to find out about a systematic nature, so that it is not only a mastery of knowledge in the form of a collection of facts, concepts or principles, but also a process of discovery. The learning process emphasizes providing direct experience through inquiry

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to develop competencies in order to scientifically explore and understand the universe (Kemdikbud, 2013). Learning science for junior high school on Curriculum 2013 is expected to reach graduate competency standards consisting of dimensions of attitudes, knowledge and skills. On the dimension of attitude, qualifying ability is expected to have behavior that reflects faithful, noble, knowledgeable, confident, and responsible attitudes to interact effectively with the social and natural environment in a range of relationships and existence. On the dimension of knowledge, qualification is an expected ability to have factual, conceptual and procedural knowledge in science, technology, arts, and culture with human insight, national, state, and civilization-related phenomena and observable events. Meanwhile, the dimensions of student qualification skills are expected to have the ability to think and the ability to follow an effective and creative in the realm of the abstract and the concrete in accordance with the learning in schools and other similar sources (Permendikbud, No 54 of 2013).

Creativity and innovation are the keys to success. Guilford (1973) suggests that ways of creativity are divergent thinking, productive thinking, inventive thinking heuristics and lateral thinking. Appropriate framework of 21st Century Learning on "Learning and Innovation" includes: creativity and innovation, critical thinking and problem solving as well as communication and collaboration in the context of high-level thinking. Higher-level thinking skills according to Krathwohl (2002) definition are the cognitive abilities of students at a level according to Bloom's taxonomy of cognitive abilities of analysis, evaluation and creation. Higher-level thinking is the embodiment of critical thinking, creativeness, and problem solving. Sternberg (2008) explains that scientific creativity skills include creating, discovering, inverting, imagining, supposing and hypothesizing. It is clear that within the framework of the 21st century, in solving problems students should be able to develop creativity and innovation, critical thinking and problem solving as well as communication and collaboration. Therefore, it is necessary to do an effort on how to develop the scientific creativity of students through the development of a model that is able to develop the ability of scientific creativity.

Scientific creativity in science education consists of several aspects which include knowledge, intellectual ability, personality and motivation, and environmental insight (Liu & Lin, 2013), the ability to learn scientific knowledge and solving scientific problems (Wang and Yu, 2011), producing certain original, useful for specific purposes (Hu, et al., 2013), and social or personal worth (Hu & Adey, 2010) as well as studying the essential nature and excellence of scientific thought (Zhang, et al., 2014). Solving problems in science requires students to explore a collection of knowledge that he has had, imagine the way to completion and often create combinations of knowledge or new techniques to achieve a solution (Nur, 2014: 73). Therefore, assessing scientific creativity will use the scientific creativity test developed by Hu & Adey (2010) in The Scientific Structured Creativity Model (SSCM) as a basis of measurement theory of scientific creativity. Indicators of scientific creative can be implemented in the learning process by using a collaborative creativity model.

Collaborative Creativity (CC) is defined as the perspective of creativity, which is an inherently social process that promotes the creative process in the form of partnership collaboration in completing group tasks (Miells & Littleton, 2007). Creativity involves a collaborative process of scientific creativity to generate new ideas through the results of social processes (social production process) taking into account the motivation of group interaction and efficiency in group work. Grossen (2011) states that the collaborative creativity is required in learning to produce a new understanding by making elaboration. The collaborative creativity plays an important role in determining the success of student learning and enhances the contribution of the scientific creativity skills (Partlow, Medeiros & Mumford, 2012). Collaborative creativity is also closely linked to the social processes and the limitation on an understanding of the creative process that affects the affective aspects of the group. The discussion on creativity and behaviour requires an understanding of the relationship between the content of cultural and social systems (Miells and Littleton, 2007: 148). Collaborative learning creativity requires the conditions in which students can design, build, and feel the social environment that can be transformed into an idea (Jones, Miells, Littleton, & Vass, 2008). When the teacher gives a task related to the involvement of students in the group, then each team member can contribute uniqueness and every effort made by students needs to be focused on the performance of collaboration. It encourages students to practice the skills of scientific creativity while helping students who do not have the skills of teamwork.

Collaborative Creativity Learning (CCL) Model is a learning model for teaching skills of scientific creativity by applying the Collaborative Creativity (CC) which describes systematic procedures and are used to guide teachers in helping students identify problems, explore creative ideas, collaborative creativity, elaboration of creative ideas and evaluation process and the results of scientific creativity. Teachers should be attentive and creative in implementing appropriate learning process that can improve scientific creative thinking ability. Teaching scientific creative thinking supports the scholars by emphasizing the links between environmental education and broader current theoretical approaches (Susantini, et al., 2016).

Based on the description above, Collaborative Creativity learning (CCL) Model is validated with two aspect in terms of: 1) the content validity of the CC instruction model judged on the aspect of CC model development needs, advanced knowledge (state of the art of knowledge) and benefit, and the results obtained are very valid, 2) the construct validity of the CC instruction model is evaluated based on CC rationality, theoretical and empirical support of CC model, syntax of CC model, social system, principle reaction, learning environment and classroom management, implementation of evaluation, and the results obtained are very valid (Astutik, et al., 2016). Furthermore, the validity result is a learning model that is valid for teaching skills of scientific creativity and the CC instruction model can be implemented for students in the class. In this case, the teachers' role is as a facilitator as well as a motivator, so the teacher should be able to continue to motivate the students to play an active role in the development of scientific creativity students.

The purpose of this research is to analyze the effectiveness of collaborative creativity learning models to train student's scientific creativity learning outcome for secondary students.

METHOD

General Background of Research

This research is used to determine the effectiveness, self-assessment and student responses of collaborative creativity learning (CCL) model. The CLL model was developed to teach the scientific creativity skills of students in learning at the secondary school SMP 3 Jember, Indonesia. The CCL model was implemented for students in the class with the syntax models, namely: 1) problem identification, 2) idea exploration, 3) collaborative creativity, 4) idea elaboration and 5) evaluation process and results.

Teaching strategies of CCL models

Implementation of CCL model in teaching was expressed in five (5) phases. The first phase is the class formed the working group of Collaborative Creativity (CC) with no discrimination based on sex/gender and individual capabilities.

First phase: Problem identification

This phase was designed to raise curiosity and interest of the students appeared on the materials studied. Teacher initiated activities by forming groups of CC (Collaborative Creativity) that consisted of 6 (six) students and motivated students with problem identification. The objectives of problem identification to enable students to get a description of the material that would be studied were further challenged to explore. Problem identification was done at the beginning of learning. The steps are described as follows: (1) apperception with activities e.g. demonstration, observation of the phenomenon of physical symptoms that occurred in everyday life, linking the material that had been previously provided with the materials studied, doing simple experiments with reference to the book of teachers. Apperception was done to assist students in understanding the material that would be studied by linking initial experience with the materials studied in scientific creativity. (2) Providing motivation in the form of a phenomenon or a question to the students to be interested and engaged in the learning process. The questions related to the environment are still relevant to the materials learned. Through these questions students are expected to propose some logical predictions and attract attention for further testing, and then (3) Delivering learning goals and objectives of problem-solving would be done and focused on students' competence to be achieve in learning. The problems posed to students may be a problem that has no strict structure (structured ill-defined) because it would arouse students' curiosity, so that they were interested in finding the answer (Arends, 2012: 405).

Second phase: Idea exploration

The second phase of the model developed was the exploration of creative ideas. In this phase, the teacher conveyed key points in the learning material and further distributed Student Worksheet (WS). Students were directed for collaborative creativity to explore ideas as much as possible in order to determine the formulation of the problem, hypotheses and the variables in learning. Students were ordered to work collaboratively on the activities undertaken to explore the notion of creativity/idea of the student group and to discuss ideas collected to get the best idea as an alternative solution to the problems posed.

Truman (2011) introduces the idea generation process as personal and social design, in which the ideas generated can involve interaction and negotiation between individuals and peers in their neighborhood. This phase is designed to prepare the laboratory activities whose activities cover three main objectives: (1) to guide students to use the scheme, the process of assimilation and accommodation to get the truth of the information learned about scientific creativity. Scheme is the way a person to organize and process information when dealing with objects in the world, assimilation is a process of understanding the object or event based schemes that already exist, and accommodation is an attempt to change the existing scheme based on new information or new experiences (Slavin, 2006), with which the scheme of assimilation and adaptation are indispensable in improving scientific creativity of students, (2) to guide discovery to help invention and discovery. Guiding discovery can help students in producing the information, converting a mental representation that is created during the encoding into motor activity (Moreno, 2010; Slavin, 2006), as well as the scaffolding will provide guidance to the students to solve problems remain on the right track (Arends, 2012), (3) create opportunities to develop scientific creativity of students who meet the characteristics of fluency, flexibility and originality through personal thinking and collaboration.

The second step, each group thinks of an alternative solution by exploring the idea as many as the members. The ideas gathered are then selected to determine which ideas best suited as a solution, or the solution can also be determined from a combination of members' ideas.

Third phase: Collaborative creativity

In the third phase, students worked in collaborative creativity that consisted of 6 members of heterogeneous group in accordance with the problem in the second phase. In this phase, the group carried out experiments based on the creativity of the group and carry out the acquisition of data. The data were then analyzed and used to answer the problem formulation and to formulate hypotheses and conclusions. Strategies in conducting collaborative creativity could be a model (modeling), training (practicing), and coaching (nurturing) (Littleton et. al., 2007: 148). Implementation of the strategy was intended to improve scientific creativity skills. In addition, students were required to be more intensive in exploring learning resources both of Textbook Student and other references as a support for the elaboration of the idea of the activities to be conducted in the next phase. Data acquisition activities were carried out by students and guided by worksheet. In addition, teachers can also provide direct assistance to students in the activities of data acquisition (generating information) that primarily supports scientific creativity (Santrock, 2013: 451). The third step, the groups in the study were formed based on individual creativity and continued with data retrieval collaboratively. Activities undertaken involved all group members to work collaboratively, and each member of the group actively contributed creative ideas and then proceeded with data.

Fourth phase: Idea elaboration

In this phase, The CC model was designed to elaborate creative ideas from the research results. Elaboration of creative ideas was done by completing N-gain of scientific creativity skills in which completion was associated with problems in the Student Worksheet (WS). Problems of scientific creativity skills were resolved by: 1) Unusual Use (UU), 2) Technical Production (TP), 3) Hypothesizing (H), 4) Science Problem Solving (SPS), 5) Creative experiment (CE) and 6) Science Product (SP). Furthermore, each group was given the opportunity to present the results of the completion of the data (generating information) to other groups and other groups would respond and give a critique of generating information that had been obtained and the data acquisition process that had been implemented. In this phase, students in groups were elaborating an idea to another idea to get the best solution to the skills of scientific creativity. The fourth step, the elaboration of creative ideas was carried out by elaborating the research results.

Fifth phase: Evaluation of process and result

Evaluation was done on the overall learning process and the evaluation based on the results obtained through elaboration of creative ideas, so that students gained an understanding of scientific creativity skills. In this phase, students had the opportunity to develop the ability to analyze, synthesize ideas, elaborate and conclude the whole process of collaborative creativity that would assist students in developing abilities of scientific creativity. In addition, teachers provided feedback to the learning process by giving corrections and strengthening the work of the students, so that Proximal Zone Development (ZPD) could be achieved. Giving feedback is important for students because the absence of feedback will make students gain a little knowledge (Arends, 2012: 308). Feedback was given to facilitate students in obtaining the right knowledge and providing input for an answer that was not fully correct, so that students really got a true concept. At the end of the activities, guided by teachers, students jointly drew up conclusions of the overall learning outcomes the process and the learning outcomes that included scientific creativity skills of students. Increased collaborative scientific and scientific creativity of students describe that students get additional scientific collaborative abilities and knowledge, scientific creativity skills.

Figure 1
Syntax of CCL Model

The fifth step, students evaluated teachers by providing feedback on students' work. Evaluation of the indicators of scientific creativity would be confirmed with the criteria for the assessment rubric of scientific creativity.

Evaluation

The students answered the written pre-test before the teacher introduced the CC Models. The pre-test consisted of six essay questions about motion material and six essay questions about simple machines material. At the end of the session, they were asked to answer other six essay questions about motion material and six essay questions about simple machines material in the post-test. The tests were assessed by rubric criteria and scored in a scale from 0 to 3 points (Table 1 and Table 2). All of the test questions were constructed based on indicators achievement (Table 1 and Table 2). All students had the opportunity to assess their own learning capabilities using a self-assessment sheet that covered scientific creativity skills indicators (Table 3). Comments were also invited on the content, so that the material could be refined to improve student's learning capability. An attempt was also made to assess students' response to the learning activities by closed questionnaire. Assessed aspects of this questionnaire were determined by the researchers based on the scientific creativity indicators (Table 4).

Actually, the test had previously been developed for secondary school students. In this study we had chosen the SCSM test with 6 tasks, i.e. unusual use, technical production, hypothesizing, science problem solving, creative experiment and science product. Researchers agreed that creativity was the production of useful new products and ideas (Nur, 2014), ability to wonder, ability to solve problems, understanding the world around, seeking solutions and ability to think (Torrance, 1990; Sternberg, 2008). According to Torrance, central features of creativity are fluency, flexibility and originality (Hu and Adey, 2002): 'Fluency means the number of original ideas produced, flexibility is the ability to 'change tack', not to be bound by an established approach after that approach is found no longer to work efficiently. Originality can be explained statistically: an answer which is rare, which occurs only occasionally in a given population, would be considered original' (Pekmes, *et. al.*, 2009: 209-214).

In this study, using SCSM test, an unusual use was designed to measure fluency, flexibility, and originality in using an object for a scientific purpose. Technical production was designed to measure fluency, flexibility, and originality in students' ability to improve a technical product. Hypothesizing was designed to measure fluency, flexibility, and originality in evaluation. The degree of sensitivity to science problems, problem solving was designed to measure fluency, flexibility, and originality in students' ability to solve the science problem. Creative experiment was designed to assess student's creative experiment ability, and science product was designed to measure creative science product design ability. Some questions of the original test had been modified according to the materials i.e. motion and simple machines. The test was administered to a sample of 70 students selected from year 8 in a secondary school in Jember, Indonesia. This research was conducted by using two groups (individual – 2 students and collaborative – 6 students) at State Junior High School of Jember, Indonesia. The research was conducted using one-group pretest-posttest design (Fraenkel, et al., 2009:265).

Instrument and Procedures

To describe the effectiveness of CC learning model, scientific creativity skills were developed based on aspects of indicators of achievement, self-assessment and student responses. The draft for the achievement of the objectives of research used descriptive quantitative approach, which described the effectiveness of CC learning model. The data were obtained by the students' scientific creativity skills based on the scores of the students' answers to the scientific creativity test. Scientific creativity test results were based on scores obtained from responses to each indicator in scientific creativity test. Indicators of scientific creativity skills included six (6) indicator items, namely: 1) item 1: Unusual Use (UU), 2) item 2: Technical Production (TP), 3) item 3: Hypothesizing (H), 4) item 4: Science Problem Solving (SPS), 5) item 5: Creative Experiment (CE), 6) item 6: Science Product (SP) (Hu & Adey, 2010: 3). Score rank on each indicator was expressed by the aspect of scientific creativity, i.e. fluency, flexibility and originality (Hu & Adey, 2010: 3). Indicators 1 to 6 had the criteria for fluency, flexibility and originality with the indicators scoring guidelines for scientific creativity skills. The evaluation form was built upon 4-point for each aspect of scientific creativity skills, i.e. fluency (0 = If no answer, 1= If the number of correct answers was 1, 2= If the number of correct answers was 2-3 and 3= If the number of correct answers ≥ 4), flexibility (0 = If no answer, 1= If the number of correct answers was 1, 2= If the number of correct answers was 2-3 and 3= If the number of correct answers ≥ 4) and originality (0 = If no answer, 1= If the probability >10%, 2 = If the probability was 5% to 10%, and 3 = If the probability <5%) (modified from Hu & Adey, 2010). The tests were assessed by rubric criteria and scored in a scale from 0 to 3 points and all of the test questions were constructed based on indicators achievement (Table 1 and Table 2.).

Data Analysis

Data collection was conducted using essay test and questionnaire with a self-assessment sheet and learning activities response sheet. The data needed to achieve the goal were the results of data learning outcome of scientific creativity skills. Data collection was conducted using essay test and questionnaire with a self-assessment sheet and learning activities response sheet. The effectiveness of students' scientific creativity skills was determined by the n-gain $<g>$.

Normalized Gain $< g >$ = (score post-test – score pre-test) / (100 – score pre-test)

The test scores were analyzed using average normalized gain $< g >$ which was defined as the ratio of the actual average gain to the maximum possible average gain, i.e. where Sf and Si are the final (posttest) and initial (pretest) class average (Hake, 1999). Hake (1999) defines g score >0.7 as a highly engaged activity to promote particular understanding; 0.7>g>0.3 as a medium-engaged activity; and g<0.3 as a poor-engaged activity. The self-assessment sheet and the learning activities response sheet were analyzed descriptively. Analysis of the data on answers to the problem and achieve the goal of the research was done by using descriptive.

FINDINGS

Based on the background of the problems, curriculum 2013 and the framework of thinking which refers to the development of a collaborative creativity models can be implemented, with reference to performed aspects of the CC model. The results of this research consist of indicator achievement, self-assessment of self-capability through observation student worksheet, and student responses to lecturer's ability to teach with CC model. The results showed that there was an improvement in indicators achievement in motion materials with average g-score = 0.66 (medium-g) (Table 1) and in simple machines material with average g-score = 0.72 (high-g) (Table 2). The pretest and posttest scores indicated that motion material and simple machines material using CC model could fairly engage students to conduct scientific creative skills. Implementation of the learning model CC was performed to obtain indicators of achievement skills of scientific creativity. Results of the indicators achievement in pretest and posttest of motion material and simple machines material are shown in Table 1 and Table 2.

Table 1
Indicators Achievement in Pre-test and Post-test of Motion Material

Indicators of Scientific Creativity Skills	Motion Average Pretest score					Average Posttest score					N-Gain	Criterion
	F	F	O	C	Score	F	F	O	C	Score		
Unusual Use (UU)	1.5	1	1	1.2	39	2.9	2.8	2.7	2.5	83.2	0.72	High
Technical Production (TP)	2	1	1.7	1.2	40.9	3	2.7	1.8	2.5	83.2	0.72	High
Hypothesizing (H)	1.5	1.3	9.7	1.1	37.6	2.8	2.6	3	2.3	81.8	0.71	High
Science Problem Solving (SPS)	1.2	0.6	0.5	0.8	25.2	2.3	1.8	1.4	1.8	61.1	0.48	Middle
Creative experiment (CE)	2.1	1.1	0.9	1.4	45.4	3	2.9	1.7	2.4	81	0.63	Middle
Science Product (SP)	1.7	1	1	1.2	40	2.9	2.5	3	2.5	81.8	0.7	High
Scientific Creativity (SC)	1.7	1	2.5	1.2	38	2.8	2.6	2.3	2.3	78.7	0.66	Middle

F = Fluency, F = Flexibility, O = Originality, C = Scientific Creativity

Table 2
Indicators Achievement in Pre-test and Post-test of Simple Machines Material

Indicators of Scientific Creativity Skills	Simple Machines Average Pretest score					Average Posttest score					N Gain	Criterion
	F	F	O	C	Score	F	F	O	C	Score		
Unusual Use (UU)	1.7	0.5	0.8	1	32.7	2.7	2.5	2.1	2.4	81.3	0.72	High
Technical Production (TP)	1.9	1.3	0.6	1.3	42.2	2.9	2.5	1.7	2.4	79	0.64	Middle
Hypothesizing (H)	1.8	1.3	0.7	1.3	42.6	2.9	2.4	3	2.5	82	0.69	Middle
Science Problem Solving (SPS)	1.5	1.1	0.6	1.1	35.6	2.3	2.1	1.5	2	65.4	0.46	Middle
Creative experiment (CE)	2.2	1.2	1.1	1.5	50.2	2.7	2.5	1.9	2.4	80.3	0.6	Middle
Science Product (SP)	1.3	0.6	0.8	0.9	30.1	2.7	2.5	2.1	2.3	81.6	0.73	High
Scientific Creativity (SC)	1.7	1	0.8	1.2	30.1	2.7	2.4	2.1	2.3	80.6	0.72	High

F = Fluency, F = Flexibility, O = Originality, C = Scientific

Average indicators of achievement of motion material for unusual use increased from 39 in pre-test to 83.2 in post-test, technical production increased from 40.9 in pre-test to 83.2 in post-test, hypothesizing increased from 37.6 in pre-test to 81.8 in post-test, science problem solving increased from 25.2 in pre-test to 61.1 in post-test, creative experiment increased from 45.4 in pre-test to 81 in post-test, and science product increased from 40 in pre-test to 81.8 in post-test. Average indicators achievement of scientific creativity skills gained 38.0 to 78.8 (Table 1.). Meanwhile, average indicators achievement of simple machines material for unusual use increased from 32.7 in pre-test to 81.3 in post-test, technical production increased from 42.2 in pre-test to 71 in post-test, hypothesizing increased from 42.6 in pre-test to 82 in post-test, science problem solving increased from 35.6 in pre-test to 65.4 in post-test, creative experiment increased from 50.2 in pre-test to 80,3 in post-test, science product increased from 30,1 in pre-test to 81,6 in post-test. Average indicators achievement of scientific creativity skills gained 30.1 to 80.6 (Table 2.). This indicated that both of motion material and simple machines material showed an improvement in test score after the CC model was implemented. Average indicators achievement in pre- and post-test is shown in Figure 2.

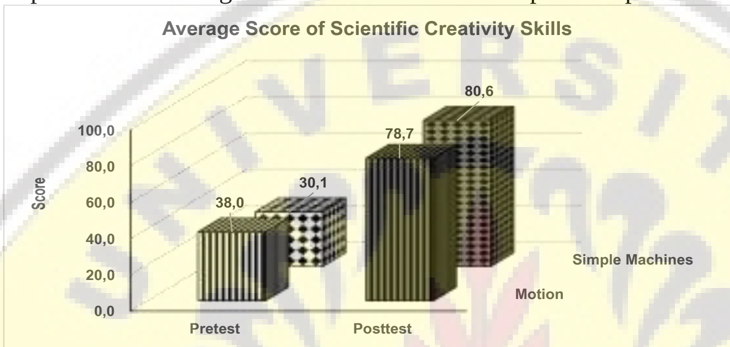

Figure 2
Average Score in Pretest and Posttest of Scientific Creativity Skills

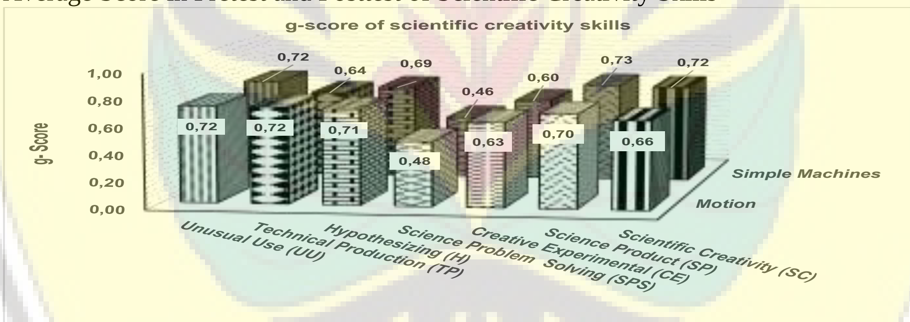

Figure 2
G-score of Scientific Creativity Skills

Implementation of CCL model in Jember, Indonesia can develop students' scientific creativity skills in order to improve the test results of scientific creativity skills as shown in Figure 2. Meanwhile, g-score of motion material for unusual use gained 0.72 (high-g), technical production gained 0.72 (high-g), hypothesizing gained 0.69 (medium-g), science problem solving gained 0.48 (medium-g), creative experiment gained 0.63 (medium-g), and science product gained 0.70 (high-g). Therefore, average g-score of motion material gained 0.66 (medium-g). Furthermore, g-score of simple machines material for unusual use gained 0.72 (high-g), technical production gained 0.64 (medium-g), hypothesizing gained 0.69 (medium-g), science problem solving gained 0.46 (medium-g), creative experiment gained 0.60 (medium-g), and science product gained 0.73 (high-g). Therefore, average g-score of simple machines material gained 0.72 (high-g). These scores indicated that collaborative creativity model could fairly engage students to conduct scientific creative skills.

Table 3
Student Self-Assessment of Self-Capability

Aspect	Answer Percentage (%) Positive	Negative
I acquire opportunity to create many ideas to answers the new and logical problem (fluency)	100	0
I acquire opportunity to provide many ideas to answers the problem from different perspective (flexibility)	94.2	7.8
I acquire opportunity to provide many ideas to answers that are question unusual or unique and clever (originality)	85.7	14.3
I acquire opportunity helpful to learn together (collaboration with friends) rather than just learn on their own (collaborative)	100	0
Total	379.9	20.1
Average Percentage	94.9	

Table 4
Students' Responses in the CCL Models Activities

Component of students' responses	Average Percentage (%) Interesting	No Interesting
Study materials are studied	95.7	4.3
Students worksheet	97.1	2.9
Student book	100	0
Teachers' performance	100	0
Teaching and learning	95.7	4.3
Classroom atmosphere	100	0
Interested in following the lesson	97.1	2.9
Total	685.6	14.4
Average Percentage	97.9	

DISCUSSION

The CCL model enables a suitable variety of opportunities for students to be creative in multiple ways. The collaborative creativity model allows students to do a research and conduct an experiment on a topic of their interest and ability under supervision of a teacher to encourage students to participate in class in order to improve their scientific creative skills, i.e. unusual use, technical production, hypothesizing, science problem solving, creative experiment and science product and social skills e.g. interaction with friend. Teacher can also increase students' interest and attention to a lesson. Using the CCL model in learning, students will be able to evaluate their own learning outcomes, develop their ability of creative skills, do experiment in laboratory and help them understand the material by themselves.

The CCL model provides a suitable variety of opportunities for students to be active in science teaching learning of motion material and simple machines material with scripted lesson plans on secondary school students, so that it gives a good value on the affective, cognitive and psychomotor abilities (Morrison, 2007; Lynch, 2009). The scientific, collaborative, affective values of science students are acquired during the learning processes including: focus on the task and participation, positive interdependence and shared responsibility, active involvement in discussions, sharing information when conducting experiments, and working together in teams. Students start to be accustomed to working collaboratively to solve problems motion material and simple machines with a focus on the task and participation, positive interdependence and shared responsibility, be accustomed to working together in teams, active discussion, sharing information and everything that can be patterned well in learning to improve scientific creativity skills. Problem solving activities in learning are presented in demanding students' complete worksheets collaboratively, so that they really work together and positive interdependence with other friends to achieve a common goal. This is in accordance with Miells & Littleton (2007) that collaborative creativity in learning emphasizes on teamwork and scientific creativity through which all students need to learn to explore the views of the team together (collaborative). Collaborative learning is easier for students to learn and work together, contribute ideas, share responsibility for the achievement of learning outcomes as a group or individually (Kagan, 1994; Slavin, 2006).

The findings show that the developed CCL model is successfully able to improve students' scientific creativity. Value skills of scientific creativity of students acquired during the learning includes indicators: the use of unusual (UU), think of ways to create new products or improve the existing ones into Technical Production (TP), raise new questions or viewpoints of new forms of imagination or hypothesis in science Hypothesizing (H), develop problem-solving capabilities of scientific students Science problem solving (SPS), testing creative experimentation with a variety of possible methods to produce creative products of creativity experimental (CE) and creative machine design of Science Product (SP) (Lin et al (2013); Wang and Yu (2011); Hu et al (2013); The study by Astutik, et al (2015) shows that the model of creativity collaborative can improve the skills of scientific creativity. Furthermore, the results of study by Astutik, et al (2018) shows that the collaborative creativity model by PhET can improve scientific creativity skills. Teachers play a role in guiding and providing feedback on the discussion and elaboration of scientific creativity. They should give specific inputs as soon as possible due. The absence of feedback makes students gain a little knowledge. To get a good mastery of scientific creativity skills, learning steps are performed using the skills of scientific work and to overcome the weaknesses of scientific work, the learning is in stages (scaffolding) to students, which gradually helps students until they gain knowledge and be freed up after a student is believed to be capable. Guidance is given to students including understanding the problem formulation, formulation of hypothesis, identification of variables and determination of the operational definition of variables. At this stage, to overcome the student' difficulties, teachers are expected to find a suitable strategy or method associated with formulating the problem, formulating a hypothesis, identifying variables and formulating an operational definition of variables to build trust and their identity in learning (Grossen, 2011: 248).

Based on the research results to the positive responses concerning how to conduct collaborative creativity models, it is found that the CCL model is helpful in helping students learn how to apply scientific creativity in science teaching together with collaborative creativity. This is in line with studies by Aktamis & Ergin (2008): Lynch et al. (2009), and Astutik et. al. (2016). Grossen (2011: 248) indicates positive views of students in science teaching that receives science learning in secondary school.

CONCLUSIONS

The results showed that the CCL model can improve indicators of scientific creativity skills, namely: unusual use, technical production, hypothesizing, science problem solving, creative experiment, and science product. Improved indicators of scientific creativity are demonstrated by the increase in the value of the pre-test to post-test on aspects of fluency, flexibility and originality. Self-assessment of students toward mastery aspects of fluency, flexibility and originality obtains high value as indicated by the positive response (94.9%) stating that students can undertake aspects of fluency, flexibility and originality in scientific creativity skills indicators. The students' response to the implementation of CCL models shows a positive response, as seen in a positive answer (97.9%) in every aspect of the student's response.

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