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Research Article

Developing Teaching Material for Physics Based on Collaborative Creativity Learning (CCL) Model to Improve Scientific Creativity of Junior High School Students

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Abstract

The teaching material for Physics based on collaborative creativity learning (CCL) model is by design to improve scientific creativity, collaborative skills, and science process skills of junior high school students. The focus of this research is to analyze the teaching materials based on CCL model in terms of their validity (content and construct, reliable) and effectiveness to improve students' scientific creativity in the science lesson, particularly for Physics education. The validity and effectiveness of the teaching material were measured by using Validation Assessment Sheet (VAS) and Scientific Creativity Assessment Sheet (SCAS). The data were analysed through mean validity score, Cronbach's coefficient alpha, Wilcoxon test, N-gain, and Mann Whitney test. The results of this study include: (1) validity of the the CCL-based teaching materials for Physics fulfill validity criteria (valid and reliable); (2) in terms of components of validity, the CCL-based teaching materials for Physics: (a) there is an increase of students' scientific creativity with the alpha of α = 0.05, (b) the average score of students' scientific creativity was in medium category, and (c) there is no significant different improvement (consistent) of scientific creativity skills in all groups. The implication of this developmental research of CCL-based teaching materials for Physics has proven to be valid and effective to increase the scientific creativity of junior high school students, particularly in Motions and Simple Machine chapters.

Keywords: *teaching material for Physics, collaborative creativity learning model, scientific creativity*

Pengembangan Perangkat Pembelajaran Fisika Berbasis Model Collaborative Creativity Learning (CCL) untuk Meningkatkan Kreativitas Ilmiah Siswa SMP

Abstrak

Perangkat pembelajaran fisika berbasis model collaborative creativity learning (CCL) adalah sebuah perangkat pembelajaran yang didesain untuk meningkatkan kreativitas ilmiah, keterampilan kolaboratif, dan keterampilan proses sains siswa sekolah menengah pertama. Fokus penelitian ini untuk menganalisis perangkat pembelajaran fisika berbasis model collaborative creativity learning yang ditentukan berdasarkan: Validitas (konten dan konstruk, reliable) dan keefektifan perangkat pembelajaran fisika berbasis model collaborative creativity learning untuk meningkatkan kreativitas ilmiah siswa SMP pada

pembelajaran IPA. Validitas dan keefektifan perangkat pembelajaran fisika berbasis model CCL diukur menggunakan Validation Assessment Sheet (VAS) and Scientific Creativity Assessment Sheet (SCAS). Analisis data menggunakan rerata skor validitas, Cronbach's coefficient alpha, Wilcoxcon test, N-gain, dan Mann Whitney test. Hasil penelitian ini meliputi: (1) Validitas perangkat pembelajaran fisika berbasis model CCL memenuhi kriteria validitas (valid dan reliabel); (2) Validitas perangkat pembelajaran fisika berbasis model CCL: (a) ada peningkatan kreativitas ilmiah siswa pada α = 0.05, (b) Skor rerata n-gain kreativitas ilmiah siswa pada kategori sedang, dan (c) tidak ada perbedaan (ada konsistensi) peningkatan signifikan pada keterampilan kreativitas ilmiah pada semua kelompok. Implikasi penelitian ini adalah perangkat pembelajaran fisika berbasis model CCL terbukti valid dan efektif untuk meningkatan kreativitas ilmaih siswa SMP pada bab gerak dan pesawat sederhana.

Kata Kunci: *Perangkat pembelajaran fisika, model collaborative creativity learning, kreativitas ilmiah*

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I. INTRODUCTION

In order to prosper in the globalization era, students of secondary schools require 21st skills such as critical thinking skills, problem solving skills, innovation, communication and collaboration [1-9], especially scientific creativity. The improvement of student's scientific creativity is one of the core goals of science education [8-9]. Scientific creativity is categorized as the higher order thinking skills to create scientific original ideas and products [8-15]. The indicators of scientific creativity in this study include unusual use (UU), creative experimental (CE), science problem solving (SPS), hypothesizing (H), technical production (TP), and science product (SP) at Science Subject (i.e. Motions and Simple Machine). Based on the results of preliminary study and literature studies by researchers, the six indicators needs to be improved, particularly by the junior high school teachers.

Results of previous research and preliminary study include: (1) students had low scientific creativity skills in Science learning, and (2) limited opportunity and support for the teachers to develop teaching materials for Physics which are specifically designed to improve student's scientific creativity [16-18].

Based on the results of the previous research and preliminary study, it was observed the gap between expectations and reality which becomes one of the main issues in the teaching of Science subject at schools, especially in the teaching of Physics in junior high school level, i.e. low of scientific creativity skills and the absence of specific teaching materials for Physics to improve student's scientific creativity in junior high school through collaborative learning and scientific inquiry.

In order to enhance student's scientific creativity, it requires innovative teaching materials for Physics, one of them is the teaching materials which integrate collaborative creativity learning (CCL) model as the solution to enhance student's scientific creativity [16-18]. The CCL model is collaborative based learning on scientific creativity which has been proven to be

feasible (valid, practical, and effective) to enhance student's scientific creativity in natural science learning [16-18]. The CCL model has five phases which include: (1) identifying problem simulation, (2) exploring creativity ideas, (3) collaborative creativity, (4) elaborating creativity ideas, and (5) evaluating the process and results of scientific creativity. The CCL-based teaching materials for Physics that have validated by experts consist of syllabus, lesson plan, student worksheet, teacher's books, student's books, and scientific creativity assessment instrument.

The quality of the CCL-based teaching material for Physics was determined based on some aspects, e.g. validity (valid and reliable) and effectiveness of the teaching materials to improve the student's scientific creativity. The validity of the CCL-based teaching material was determined to meet the criteria of validity (valid and reliable). In terms of the effectiveness, the CCL-based teaching materials were measured by the following aspects, namely (1) significant improvement (statistically) on the student's scores during pre-test and post-test in terms of scientific creativity, (2) the average n-gain which was determined at least on the low improvement criteria, and (3) the consistency of the average n-gain score of the student's scientific creativity.

This research focuses to analyze qualified teaching material based on CCL model for Physics based on validity (valid and reliable) and effectiveness of the teaching material to improve student's scientific creativity on natural science learning. This research was conducted to find the answers to the following questions:

(1) To what extend is the validity of the CCL-based teaching materials for Physics to improve student's scientific creativity?
(2) To what extent the effectiveness of the CCL-based teaching materials for Physics to improve the student's scientific creativity?

II. RESEARCH METHOD

The focus of this research is to analyze the quality of the CCL-based teaching material for Physics in terms of validity (valid and reliable) and effectiveness of the teaching to improve the student's scientific creativity. The validity of the CCL-based teaching material was determined based on the results of the assessment with the average score of validity and Cronbach's alpha. The effectiveness of the CLL-based teaching material was analyzed based on the assessments that have been determined before and after the application the teaching material. The results of pre-test, post-test, and n-gain of student's scientific creativity were further analyzed by using inferential statistics. The determination of the statistical testing methods relies on fulfilling the assumptions of normality and homogeneity of variants during the pre-test, post-test, and n-gain of the student's scientific creativity. The n-gain was determined by using the equation: n-gain [19].

Sample of Research

The samples were determined based on the Slovin's formula, i.e.

$$Sample = \left(\frac{population}{1 + e^2 \times population} \right) \quad (1)$$

with error tolerance e = 5% [20]. The samples in this research consisted of 144 junior high school students who took the Science subject in 2017 at two public junior high schools in Jember, Indonesia, i.e. SMP Negeri 2 Jember and SMP Negeri 3 Jember. There were four groups, namely Group A (36 students of Class VIII-A SMP Negeri 3 Jember), Group B (36

students of Class VIII-B SMP Negeri 3 Jember), Group C (36 students of class VIII-A SMP Negeri 2 Jember), and Group D (36 students of class VIII-B SMP Negeri 2 Jember).

Instruments and Procedures

The validity of the CCL-based teaching material for Physics was a quality of teaching material that consisted of needs, state of the art, and consistency [16-17, 21-23]. The validity of the teaching material was measured by using the validation assessment sheet of the construct and content validity [16]. The validity of the teaching material was obtained through focus group discussion (FGD) involving three experts on the area of Science Education at State University of Malang. The results of the FGD were utilized as the reference to revise the teaching material. The effectiveness of the teaching material being developed is to achieve the ultimate goal that is to enhance the students' scientific creativity, science process skills, and affective collaboration [16-17, 21-23]. The effectiveness of the CLL-based teaching material for Physics was measured by using the Scientific Creativity Assessment Sheet (SCAS) [16], consisting of six problems based on scientific creativity indicators, e.g. unusual use (UU), creative experimental (CE), science problem-solving (SPS), hypothesizing (H), technical production (TP), and science product (SP). The validation assessment sheet (VAS) and scientific creativity assessment sheet (SCAS) were valid and reliable [16].

This research employed pre-test and post-test design [24-26]. The learning began by giving pre-test (O_1). Each student was required to complete SCAS. After the pre-test, the teacher distributed the teaching material to each group. The implementation of the teaching material was conducted for seven meetings. The lesson plan of Motions topic was developed for four meetings, with the detail content of the chapter consists of Lesson Plan 01 was used for Straight Motion topic, Lesson Plan 02 was used for Newton's Law topic, Lesson Plan 03 was used for Newton's Second Law topic, and Lesson Plan 04 was used for Newton's Third Law topic. The lesson plan for Simple Machine topic was designed for three meetings, with detail contents consisting of Lesson Plan 05 was used for Leverage topic, Lesson Plan 06 was used for Inclined Plane topic, and Lesson Plan 07 was used for Pulley topic.

The CCL learning model has five stages, namely (1) identifying problem, (2) exploring creativity ideas, (3) collaborative creativity, (4) elaborating creativity ideas, and (5) evaluating the process and results of scientific creativity [16-17]. For the stage 1 (problem identification), it is intended to establish collaborative creativity through group working through the help of PhET Simulation.

Stage 2 (exploration of creativity ideas), the groups are encouraged to think of alternative solutions by exploring the ideas as much as possible within its member. Stage 3 (collaborative creativity), the group works in collaborative experiments with the assistance of PhET Simulation based on group creativity and data collected.

Stage 4 (elaboration of creativity ideas), the elaboration of the creativity idea is accomplished by completing grains of scientific creativity whose completion is associated with learning materials. The items of scientific creativity that are solved are: 1) UU, 2) TP, 3) H, 4) SPS, 5) CE, and 6) SP.

Stage 5 (evaluation of scientific creativity process and results), evaluation of the whole process was done by providing feedback on students' work. Students were also asked about their impression towards learning activities with the assistance of PhET Simulation.

The implementation of the CCL-based teaching material for Physics was ended with post-test by using SCAS. Each junior high school student was required to complete SCAS in post-test.

Data Analysis

The validity of the teaching material was determined by the validity of the content and the validity of the construct. The results of the FGD were served as the reference to revise the CLL-based material based for Physics.

The validity of the teaching material was determined based on the results of the assessment with the average score (C) of validity criteria [16-17,21], and it is presented in Tabel 1.

Table 1. Validity criteria

Score	Criteria
$3.25 < S \leq 4.00$	Very Valid (VV)
$2.50 < S \leq 3.25$	Valid (V)
$1.75 < S \leq 2.50$	Less Valid (LV)
$1.00 \leq S \leq 1.75$	Invalid (I)

Further analysis to determine the quality of the CCL-based teaching materials in terms of the reliability was done by using Cronbach's coefficient alpha.

The effectiveness of the teaching material was analysed based on the assessments that had been determined before and after the implementation of the CCL-based teaching material [16]. The results of the pre-test, post-test, and n-gain of students' scientific creativity were further analysed by using inferential statistics by using SPSS software. The determination of statistical testing methods relies on fulfilling the assumptions of normality and homogeneity of variants for the pre-test, post-test, and n-gain of the students' scientific creativity.

The *n*-gain was determined by using the Hake's equation [19] with the following criteria: (1) if n-gain $\leq .30$ (low), (2) if $.30 <$ n-gain $<.70$ (moderate), and (3) if n-gain $\geq .70$ (high)

III. RESULTS AND DISCUSSION

Validity of CCL-based Teaching Material for Physics

The teaching materials being developed are to support the implementation of the CCL model by creating Teacher Book Prototype for Natural Science. The validation of the teaching material was done by considering some elements, e.g. syllabus, lesson plans, student's worksheet, student and teacher's books, scientific creativity assessment sheet (SCAS), practical learning observation sheet, and student's response questionnaire that was in particular developed for Motions and Simple Machine chapters to support the implementation of the CCL model. The chapter Motions consists of four face-to-face meetings that were organized into four books, namely the teacher and student's book prototypes, i.e. Straight Motion topic, the teacher and student's book prototype of Newton's First Law topic, the teacher and student book prototype of Newton's Second Law topic, and the teacher and student book prototype of Newton's Third Law topic. In Simple Machines chapter, it consists of three books, they are the teacher and student's book prototype of Leverage topic, the teacher and student's book prototype of Slope topic, and the teacher and student's book prototype of Pulley topic.

All components of the teaching material were validated by three experts as the validators. The results of the validation results by three validators for each component of the teaching material as shown in the following description. The validity of the syllabus is indicated by the results given by the expert of syllabus. The results of the syllabus validation for two chapters, e.g. Motions and Simple Machines chapters are categorized as very valid (VV) category as presented in the Table

2. A valid and reliable Syllabus can be utilized as a guidance in developing relevant teaching material. The teaching materials prepared include lesson plan, student's book, worksheet, and also rating sheet. These results indicate that the developed syllabus can be utilized to support the implementation of the CCL model in Physics education.

Table 2. Validation Result

Components of the Teaching Materials for Physics	Chapters					
	Motions			Simple Machines		
	Score	Validity	Reliability	Score	Validity	Reliability
Syllabus	3.91	VV	Reliable	3.90	VV	Reliable
Lesson Plan	3.86	VV	Reliable	3.91	VV	Reliable
Student's Worksheet	3.87	VV	Reliable	3.80	VV	Reliable
Student and Teacher's Book	3.91	VV	Reliable	3.90	VV	Reliable
Scientific Creativity Assessment Sheet (SCAS)	3.71	VV	Reliable	4.00	VV	Reliable
Practical Learning Observation Sheet	3.87	VV	Reliable	3.87	VV	Reliable
Student's Response Questionnaire	3.71	VV	Reliable	3.71	VV	Reliable

Note: VV (Very Valid)

The validity of the lesson plan is indicated by the validation results of by the lesson plan instrument. The lesson plan's validation results for the two chapters, Motions and Simple Machines, are categorized into the very valid (VV) level, and the data are presented in Table 2. The results show that the developed lesson plan can be used to support the implementation of the CCL model. This indicates that the developed lesson plan is in line with the syllabus and described the learning implementation plan. The activities designed in the lesson plan refer to the achievement of specific basic competencies at each meeting with the intention of making it easier for students to understand the scientific collaborative affiliations and scientific creativity.

The implementation of learning activities in Science class that had been planned carefully as stated in the lesson plan in Motions and Simple Machine chapters gave good values on affective, cognitive and psychomotor aspects. The obtained indicators of students' academic collaborative skills value during the learning were: focus on tasks and participation, positive interdependence and sharing responsibilities, actively engaging in discussions, sharing information while conducting experiment, and working together on teams. Students were accustomed to working collaboratively in solving the problems on the topics, e.g. Motions and Simple Machines, with the focus on task and participation, positive interdependence and sharing responsibilities, working together in teams, active discussions, sharing information and all can be well patterned in learning to enhance the scientific creativity.

The developed lesson plan describes the sequence of integrated learning steps in the CCL model phases. Student activities start from identifying the problem on the daily phenomena that is put forward by the teacher. Students are encouraged to formulate problems and hypotheses collaboratively based on the daily phenomena that have been provide by the teachers, and the students should understand the problems stated in the worksheet. The day-to-day phenomenon requires students to be able to explore the idea of creativity, in which the students are required to explore their idea of chapters Motions and Simple Machines based on the

given phenomenon, of which the results would be expressed in the hypothesis formulation. This indicates that the exploration process needs to be completed by appropriate guidance to help students learning as what teacher expects, and the teacher facilitates the social interaction to encourage the students in the process of knowledge construction and skill development [27].

The model's step in the lesson plan that describes students' activities on the collaborative aspects of Science subject is also seen during the experimental activities that is in the collaborative creativity phase. In this experimental activity, students carry out the model's activities in accordance with the existing aspects of scientific collaborative skills. The teaching material which was developed to teach the students about collaboration was collaborative worksheets that have proved to be effective in promoting scientific collaborative skills and students' scientific creativity skills [16].

Learning activities are closed with evaluation of the processes and results related with the scientific creativity and collaborative skills. At this stage, students interacted in the results of discussion by providing feedback each other on the learning that had been implemented so that this situation helped students to develop their ability in affective and cognitive aspects.

The validity of Teacher and Student's Natural Science Book prototype was indicated by the validation results that were given by the respective experts. The Teacher and Student's Natural Science Book prototype is a set of learning materials which includes syllabus, lesson plan, student's book, and worksheet and assessment sheet. This prototype was developed with the aim to ease the teachers to prepare the learning activities more practically. The prototype was designed by combining teacher's books, student's books and lesson plan instrument into one book package.

The main goal is that teachers no longer have to carry teacher's books, student's books and lesson plan and other instruments separately. The prototype book is the only material to bring as one book package. The validation results of the Teachers and Student's book Prototype for two chapters (Motions and Simple Machines) are categorized in the very valid (VV) and reliable category as it is shown in Table 2. The results show that the developed teachers and student's book prototype can be used to support the implementation of CCL Model in the Science classroom.

The contents of the teacher and student's book prototype are syllabus, lesson plan, worksheet, and assessment sheet and are discussed separately. Therefore, this section will only discuss about the student's book. The student's book developed for Chapter Motions and plane prototype chapter has been categorized as very valid (VV) as shown in Table 2, it means that the book can be used by the students and teachers in learning process. The chapters and presentations in the student's book have been adapted to the skills to be achieved, that are scientific creativity and scientific collaborative skills so that the student's book facilitate the accomplishment of the knowledge related with scientific creativity and collaborative skills.

The student's book is compiled as a result of the Curriculum 2013 (K-13) and standard books like Glencoe. Students can use the student's book along with other learning resources even though this student's book is already considered to represent the main roles of teachers in the learning process. The detail descriptions in the student's book provide easy guidance for students, even for student-centered learning.

The validity of student worksheet is obtained from the validation results as shown in Table 2, which states that the worksheet in motion and simple machine chapters are

included in the very valid (VV) category. Thus the developed worksheet can be used as a learning resource in teaching natural science and teaching scientific creativity and collaborative skills. The activity steps in the worksheet lead students to work by using collaborative working and solve scientific creativity in a structured way. Thus students can perform scientific collaborative skills and develop scientific creativity skills.

The problem-solving tasks included in the worksheet require students to work in a collaborative way, so that the students should really work together and be positive each other with their partners to achieve their common goals.

The validity of the scientific creativity assessment sheet was indicated by the results of validation of all scientific creativity indicators, and the results are included in the very valid (VV) and reliable category as shown in Table 2. The test items for all scientific creativity indicators UU, TP, H, SPS, CE and SP are included into valid and reliable category. These results indicate that student's skills in the unusual use of things scientifically (acting, asking new questions or new points of view in the form of imagination or hypotheses in science H, figuring out ways to make new products or improving the existing ones into something new TP, developing scientific problem solving skills SPS, conducting creative experimental testing with possible methods to produce creative products CE and designing a creative engine design SP) can be measured by using a Scientific Content Test Assessment Sheet [11]. This is in line with the results of previous studies [11-12] which state that the measurement of scientific creativity should be focused on creative thinking and scientific processes.

Based on the analysis of all teaching materials, it can be asserted that the developed teaching materials are categorized into very valid (VV) criteria so it is believed to support the implementation of the CCL Model in the classroom. This is in line with the demands of the Curriculum 2013 which states that students are at the end prepared to achieve the objectives of the Curriculum 2013, that is to become a fully person who has the ability to live as an individual and citizen who is faithful, productive, creative, innovative and affective and able to contribute to community's life, nation, state, and civilization of the world.

The Effectiveness of CCL-based Teaching Materials for Physics

The effectiveness of the teaching materials which have been developed based on CCL model for Physics is presented in Table 3, Table 4, and Figure 1. Figure 1 describes the average score gained during pre-test, post-test and *n*-gain of scientific creativity in all groups, particularly for Motions and Simple Machines chapters. In all groups, the average pre-test score was 0.72-1.17 (low category). During the reflection, students felt they were never prepared to enhance scientific creativity. The findings were in accordance with the results of preliminary studies that the scientific creativity of junior high school students was in general still relatively low [16]. This finding also corroborates the results of similar research [1-9,16-18] that prior to the implementation of innovative models, the majority of students still have difficulties in scientific creativity skills, critical thinking skills, collaborative, and problem solving. The underlying causes of scientific creativity are in accordance with functional stability theory [28].

In contrast to the scores during post-test, after the utilization of the CCL-based teaching materials in all groups in Chapter Motions, the scores were 2.30. 2.54, 2.33, and 2.33 (moderate category); detail scores are presented in Figure 1. Figure 1 shows that the

n-gain of creativity of the students for Motions topic was 0.41, 0.55, 0.41, and 0.41 (moderate category). Figure 1 shows a positive result that the scores during post-test after the utilization of the CCL-based teaching material in Physics classroom in all category were 1.06, 1.17, 1.13, and 1.16 (moderate category). Figure 1 shows that n-gain of scientific creativity of the students for Simple Machine topic in all categories were 0.49, 0.43, 0.42, and 0.45 (moderate category).

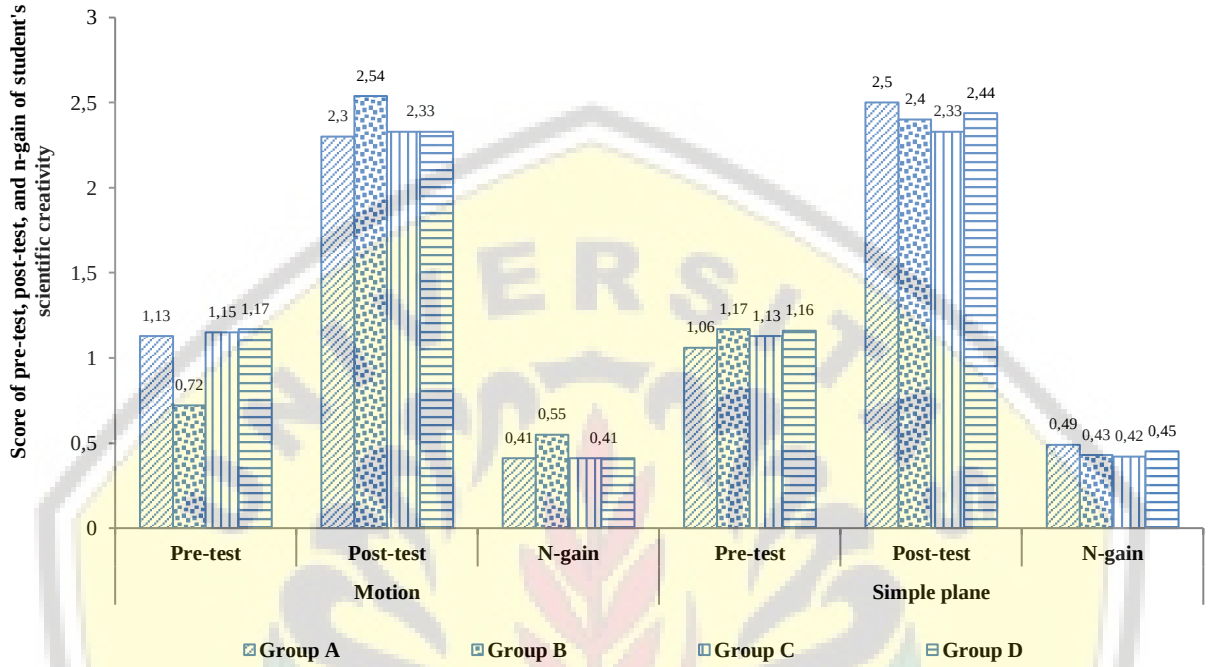

Figure 1. The scores of Pre-test, Post-test, and N-gain of Scientific Creativity

This was because the scientific creativity included in the CCL-based teaching materials has met the validity (content and construct aspects) to improve the scientific creativity and scientific collaboration of junior high school students [16-17]. It is supported by the result of other similar research [1-9, 16-17, 21-23] that feasible product (model, method, strategy, and material) in terms of validity (content and construct aspects), practicality, and effectiveness will improve and achieve the learning objectives. The finding of an increase in the scientific creativity fits Vygotsky's social constructivist theory [29-30]. Scientific investigation activities by using science process skills have an important role in improving the scientific creativity of junior high school students [31-32].

Table 3 shows that all indicators of critical thinking skills in the pre-test are in the low category, whereas after the utilization of the teaching material developed based on CCL model, all indicators of junior high school students' scientific creativity has increased. The n-gain of all creativity indicators of junior high school students is generally in the moderate category with the score of above 0.36. The positive result is believed due to the utilization of the CCL-based teaching materials for Physics class which has been specifically designed to improve the indicators of scientific creativity including Act, TP, H, SPS, CE, and SP through each phase of the CCL Model [16].

Table 3. The average scores of Pre-test Score, Post-test, and N-gain of Scientific Creativity

Groups	Scores	Students' scientific creativity on junior high school											
		UU		TP		H		SPS		CE		SP	
Chapter Motions													
Group A	O1	1.20	L	1.20	L	1.30	L	0.60	L	1.40	L	1.10	L
(Class VIIIA)	O2	2.50	M	2.20	M	2.50	M	1.90	M	2.40	M	2.30	M
	<g>	0.46	M	0.36	M	0.44	M	0.38	M	0.38	M	0.41	M
Group B	O1	1.20	L	0.70	M	1.20	M	0.60	L	1.20	L	1.10	L
(Class VIIIC)	O2	3.63	H	2.20	M	2.50	M	2.00	M	2.40	M	2.40	M
	<g>	0.87	M	0.45	M	0.46	M	0.41	M	0.43	M	0.45	M
Group C	O1	1.20	L	1.30	L	1.30	L	0.60	L	1.40	L	1.10	L
(Class VIIIA)	O2	2.50	M	2.20	M	2.50	M	1.90	M	2.40	M	2.30	M
	<g>	0.46	M	0.33	M	0.44	M	0.38	M	0.38	M	0.41	M
Group D	O1	1.20	L	1.30	L	1.10	L	0.80	L	1.40	L	1.20	L
(Class VIIIB)	O2	2.50	M	2.50	M	2.30	M	1.80	M	2.40	M	2.50	M
	<g>	0.46	M	0.44	M	0.41	M	0.31	M	0.38	M	0.46	M
Chapter Simple Machine													
Group A	O1	1.20	L	1.20	L	1.30	L	0.60	L	1.10	L	1.00	L
(Class VIIIA)	O2	2.50	M	2.20	M	2.40	M	1.40	M	2.40	M	2.40	M
	<g>	0.46	M	0.36	M	0.41	M	0.24	M	0.45	M	0.47	M
Group B	O1	1.10	L	1.20	L	1.30	L	1.10	L	1.50	L	0.80	L
(Class VIIIC)	O2	2.50	M	2.20	M	2.40	M	2.00	M	2.50	M	2.40	M
	<g>	0.48	M	0.36	M	0.41	M	0.31	M	0.40	M	0.50	M
Group C	O1	1.20	L	1.20	L	1.30	L	0.70	L	1.60	L	0.80	L
(Class VIIIA)	O2	2.50	M	2.20	M	2.40	M	1.90	M	2.40	M	2.40	M
	<g>	0.46	M	0.36	M	0.41	M	0.36	M	0.33	M	0.50	M
Group D	O1	1.40	L	1.10	L	1.30	L	1.10	L	1.50	L	0.60	L
(Class VIIIB)	O2	2.60	M	2.40	M	2.50	M	2.00	M	2.40	M	2.30	M
	<g>	0.46	M	0.45	M	0.44	M	0.31	M	0.36	M	0.50	M

Note: UU (Unusual Use); TP (Technical Production); H (Hypothesizing); SPS (Science Problem Solving); CE (Creative Experimental); SP (Science Production); L (Low); M (Moderate); H (High)

In addition, students are also skillfull in the unusual use of scientific objects of the Act, asking new questions or new points of view in the form of imagination or hypotheses in science H, thinking of ways to make new products or improve existing ones into something new TP, developing scientific problem-solving skills SPS, conducting creative experimental testing with possible methods to produce Creative Experimental (CE) creative products and designing a creative engine design SP [11-12,16].

Different pre-test and post-test of scientific creativity tests refered to Wilcoxon Matched Pairs and the n-gain scientific creativity consistency test refered to Mann-Whitney U, and the results are presented in Table 4.

Table 4. Inferential Statistical Test Results of Scientific Creativity

Inferential test (*two-tailed*)	Schools	Classes	Data of Scientific Creativity	Asymp Sig. (α = 5%)
Wilcoxon Matched Pairs (Differential test of Pretest-Posttest)	SMP N 2 Jember	Group A (VIIIA)	Chapter Motions	0.00
			Chapter Simple Machines	0.00
		Group B (VIIIC)	Chapter Motions	0.00
			Chapter Simple Machines	0.00
	SMP N 3 Jember	Group C (VIIIA)	Chapter Motions	0.00
			Chapter Simple Machines	0.00
		Group D (VIIIB)	Chapter Motions	0.00
			Chapter Simple Machines	0.00
Mann-Whitney U (N-gain consistency test)	SMP N 2 Jember	Group A (VIIIA) Group B (VIIIC)	Chapter Motions	0.36
		Group C (VIIIA) Group D (VIIIB)	Chapter Simple Machines	0.34
	SMP N 3 Jember	Group A (VIIIA) Group B (VIIIC)	Chapter Motions	0.24
		Group C (VIIIA) Group D (VIIIB)	Chapter Simple Machines	0.21

Table 4 shows the results of statistical tests for average differences in pre-test and post-test of creativity of the students for Groups A, B, C, and D in Chapter Motions and Simple Machines. Asymp Sig. is considered significant because Asymp Sig. < 0.05. It also indicates that there is an impact of applying the CCL-based teaching materials for Physics class of which is believed to increase creativity of the students significantly for all groups.

Table 4 informs that the significance score of Asymp. Sig. is 0.36 and 0.341 in Groups A and B in SMPN 2 Jember. As the Asymp Sig. > 0.05, it clearly indicates that there is no significant difference (existence of consistency) of creativity improvement of the students as the impact of applying the CCL-based teaching materials in Physics learning, particularly in Group A and Group B in SMPN 2 Jember. Other information in Table 4 shows the significance score of Asymp. Sig. is 0.24 and 0.21 in Groups C and D in SMPN 3 Jember. As the Asymp. Sig. > 0.05, it clearly indicates that there is no significant difference (existence of consistency) in creativity improvement of the students as the impact of utilizing the CCL-based teaching materials in Physics class for Groups C and D in SMPN 3 Jember.

This improvement of the creativity as well as the score for Physics class of the students is believed as the impact of the utilization of the CCL-based teaching materials which have been developed both theoretically and practically. In addition, the improvements by the teaching materials are also found in terms of motivation theory, creative process theory, social constructivist theory, cognitive psycho-theory, and behavioral learning theory [16-17, 29-30].

These results are in line with the other relevant researches [1-9, 16-17, 21-23] that the products (models, methods, strategies, and materials) which meet the validity (content and construct aspects), practicality, and effectiveness will improve and achieve the learning objectives. Therefore, the teaching materials for Physics class based on CCL model are effective to improve the creativity of junior high school students in physics learning. The teaching material based on CCL model are designed to improve scientific creativity, affective collaborative, and science process skills of junior high school students. The teaching material is developed to support the implementation of the CCL model and is structured in the form of a book that is called as Natural Science Teacher Book Prototype.

IV. CONCLUSION

The results of this research are: (1) The validity of the teaching materials based on CCL model for Physics class has met the validity criteria (valid and reliable aspects); (2) The effectiveness of the teaching materials can be seen as follows: (a) there is an improvement in students' scientific creativity at $\alpha = 0.05$, (b) the average scores of n-gain of students' scientific creativity is in moderate category, and (c) there is no significant difference (consistent) of improvement of scientific creativity of the students in all groups. The implication of this research is that the teaching materials are proven valid and effective to increase creativity of the students for Chapters Motions and Simple Machines, so that it can be used as the alternative materials by the Government to increase students' scientific creativity in junior high school level in Indonesia. Further research can be done by: (1) developing additional teaching materials based on CCL model other than Motions and Simple Machine topics; (2) implementing the teaching material to improve the science process skills and scientific collaborative skills of junior high school students.

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