Journal ofTurkish Science Education, 2021, Covid-19 Special Issue, 77-90
DOI no:10.36681/tused.2021.73

Journal of Turkish Science Education
http://www.tused.org
© ISSN: 1304-6020

Online Scientific Creativity Learning (OSCL) in Science Education to Improve Students' Scientific Creativity in Covid-19 Pandemic

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ABSTRACT
The Wademen Model was chosen to develop the Online Scientific Creativity Learning (OSCL). The quality of OSCL is measured using an expert validation sheet. Students' scientific creativity is assessed using the Scientific Creativity Test Instrument (SCTI) and then analyzed through N-gain and parametric inferential statistical tests. The OSCL has been proven effective in increasing students' scientific creativity during the Covid-19 pandemic. There is no significant difference (N-gain at a moderate level) between OSCL and Creativity Responsibility Based Learning (CRBL), except with Conventional Learning (N-gain at low level). The results of students' scientific creativity are at a high level after using OSCL and CRBL, while conventional learning is low. The OSCL can be an alternative for the scientific creativity of students in science education. Besides, OSCL facilitates the responsibility and science process skills which are characteristic of being emphasized in the learning phases. The OSCL can be a learning innovation in science education to improve students' scientific creativity in the Covid-19 pandemic.

ARTICLE INFORMATION
Received:
05.01.2021
Accepted:
27.06.2021

KEYWORDS: Covid-19 pandemic, higher education, learning innovation, OSCL, scientific creativity

Introduction

Scientific creativity cannot be separated from a part of human life. Scientific creativity is very important to train students as a provision for success in the world of work (Pangastuti & Fadhillah, 2020; Suyidno et al., 2019; Zulkarnaen et al., 2017). Scientific creativity is skills to produce new ideas or new products that are relevant to the context and have scientific uses (Hu et al., 2010; Hu et al., 2013; Kang et al., 2015; Ozdemir & Dikici, 2017; Park, 2012; Raj & Saxena, 2016; Zainuddin et al. 2020). Therefore, educators are obliged to train scientific creativity so that students can be successful. However, the results of preliminary found that the students' scientific creativity in physics at the Universitas Negeri Surabaya (i.e. Indonesia) was still low. Low scientific creativity is caused by conventional and monotonous learning which tends only to conceptualize and manage routine problems, as well as scientific activities through experiments (Zainuddin et al. 2020). The research results of Suyidno, Dewantara, Nur, & Yuanita (2017), which show the need to improve scientific investigation by optimizing scientific process skills in constructing knowledge and increasing the scientific creativity of students.

The low level of high-order thinking skills (i.e. scientific creativity) of students has something to do with the learning process used. Conventional learning is less able to facilitate learning, resulting in low learning achievement including low scientific creativity (Hammond et al., 2015; Jatmiko et al., 2016). Therefore, to improve the quality of learning to facilitate the improvement of students' scientific creativity, among others is by implementing Creative Responsibility Based Learning (CRBL). Creativity Responsibility Based Learning (CRBL) is a creative learning model that optimum responsibility of the student in the success of scientific investigations and scientific creativity tasks (Suyidno et al., 2019; Suyidno et al., 2017). The results showed that CRBL was effective in increasing scientific creativity, science process skills, and responsibility (Suyidno et al., 2019; Suyidno et al., 2017). However, CRBL has been implemented through face-to-face learning.

The problem that arises in 2020 is that in Indonesia, learning has shifted to online learning (Abidah et al., 2020; Famularsih, 2020). The cause is the Covid-19 pandemic. The increasing development of Covid-19 virus cases in Indonesia has prompted working and doing activities from home or Work From Home (WFH). This policy from the government has been responded to positively by the Universitas Negeri Surabaya by issuing several policies related to lectures on campus, one of the important core contents is that face-to-face lectures are eliminated and replaced by online lectures and continue to study at home. This is not only positive but still creates new problems, namely that not all students and lecturers are ready for online learning. Besides, students' scientific creativity also needs to be improved, but students must stay at home because face-to-face lectures are eliminated and replaced by online. It is necessary to find a solution point for solving the problem so that there is no decrease in the quality of student graduates, including scientific creativity. Therefore, alternative solutions in this research aim to produce an effective Online Scientific Creativity Learning (OSCL) to increase students' scientific creativity. This alternative solution has never been done in previous research at the regional, national, and international levels. Another positive side is the existence of new innovative outputs that can be an alternative solution in the era of the Covid-19 pandemic.

Scientific Creativity

Students try to engage at every stage of creativity when they perceive some deficiency or mismatch, tension, or stimulation. The habit of avoiding the usual solutions by investigating, diagnosing, manipulating, making guesses and testing hunches, modifying and retesting until they find the desired solution (Al-khatib, 2012; Blascova, 2014; Cocu et al., 2015; Didin & Wiji, 2020; Gregory et al., 2013; Laisema & Wannapiroon, 2014; Saliceti, 2015; Yusnaeni et al., 2017; Zubaidah et al., 2017). Scientific creativity is emphasized on indicators of determining the usefulness of objects for scientific purposes, finding scientific problems, increasing the usefulness of a product technically, imagining scientifically, designing creative experiments, solving scientific problems creatively, and designing products creatively (Hu & Adey, 2010; Astutik et al., 2020; Chin & Siew, 2015; Florence et al., 2015; Rizqi et al., 2020; Usta & Akkanat, 2015; Zainuddin et al 2020). Very important to increase students' scientific creativity in the process of the Covid-19 pandemic. In terms of scientific creativity, researchers began working toward developing a vaccine against this novel coronavirus as soon as its genetic sequence became available in February 2020 (Kapoor & Kaufman, 2020; Ren et al., 2020). The improvement of scientific creativity in the science (i.e. physics) learning process can be done through (a) scientific investigation, involving scientific process skills in scientific investigation activities; (b) understanding, involving students in understanding knowledge creatively; (c) presentations, involving students in building their knowledge through the delivery of ideas and sharing creative ideas with others; (d) application, facilitating students to find new ways of explaining scientific phenomena, making predictions, solving problems, and stating or implying what is not known; and (e) transformation, students are allowed to propose changes based on their knowledge and thoughts (Daud et al., 2012; Dhir, 2014; Kadayifci, 2017; OECD, 2014; Zainuddin et al 2020).

Online Scientific Creativity Learning (OSCL)

OSCL is an online learning model that emphasizes responsibility and scientific skills in enhancing scientific creativity. The development of the learning process in the OSCL is based on the scientific creativity hypothesis (Hu & Adey, 2010), and the latest learning theories: constructivism theory, complex cognitive processes, advanced organizer, and scaffolding (Arends, 2012; Eggen & Kauchak, 2013; Solso et al., 2008). OSCL was developed with the main aim of enhancing students' scientific creativity. OSCL has 5 (five) online-based syntaxes, namely: Generating scientific creativity, Organizing creative learning needs, Guiding the investigation, Establishing scientific creativity, Evaluation and Reflection.

Table 1
Activities of OSCL using ZOOM platform

Activities of OSCL
Phase 1: Generating scientific creativity (± 10 minutes) 1. The lecturer opens the lesson by saying greetings then checks the attendance of students through the ZOOM application. 2. Flipped learning requires students to learn teaching materials at home independently before learning to use ZOOM. 3. Through the ZOOM application, the lecturer motivates by asking students to imagine or think outside the box to mention as many scientific uses as possible. 4. Through the ZOOM application, lecturers convey learning objectives, then remind that a sense of responsibility can generate imagination and courage to be more open to new, more creative ideas.
Phase 2: Organizing creative learning needs (± 10 minutes) 1. Through the ZOOM application, lecturers guide students in understanding science process skills, the need for tools and materials, as well as the PhET media for experiments referring to student activity sheets. 2. Through the ZOOM application, lecturers ask students to actively participate and ensure that they have teaching materials and student activity sheets, and logistics.
Phase 3: Guiding the investigation (± 60 minutes Through the ZOOM application, lecturers guide students to develop a sense of responsibility to solve problems referring to student activity sheets and key student activity sheets (containing indicators of scientific creativity) includes: 1. Write down as many problem formulations as possible to investigate and isolate the problems to be selected for investigation. 2. Planning experiments. 3. Carry out the best possible experiment to get the correct data.

Activities of OSCL
4. Analyze data and study various reference sources, especially teaching materials to find solutions to problems you want to solve accurately and deeply.
Phase 4: Establishing scientific creativity (± 60 minutes) Through the ZOOM application, the lecturer asks students to relearn indicators of scientific creativity along with examples of test items listed in teaching materials, then give responsibility in making two points of scientific creativity tests and their solutions with indicators according to the division of group tasks as follows: 1. Through the ZOOM application, the lecturer guides students in the best possible presentation of the ZOOM and asks students to give suggestions to other students who are presenting. 2. Through the ZOOM application, lecturers help students discuss material and examples of problems in teaching materials, especially those that are not yet understood.
Phase 5: Evaluation and Reflection (± 10 Minutes) 1. Through the ZOOM application, the lecturer evaluates scientific creativity and reflecting on their responsibilities during the process of learning. 2. Through the ZOOM application, the lecturer asks students to work on an assessment sheet (if there is insufficient time, it can be continued independently). 3. Through the ZOOM application, the lecturer reminds students to re-learn materials for the next meeting.

The reasons why these activities were used (See Table 1) are adapting activities from CRBL that have been proven valid, practical, and effective to increase scientific creativity (Suyidno et al, 2018). However, there are fundamental differences in OSCL, namely science learning carried out using ZOOM and during the Covid-19 pandemic, this has not been used in the implementation of CRBL. Table 1 describes the five phases of OSCL. OSCL was specifically developed to increase students' scientific creativity in science learning during the Covid-19 pandemic. In phase 1 (Generating scientific creative) has two points activities: (1) the lecturer motivates by asking students to imagine or think outside the box to mention as many scientific uses as possible; (2) Through the ZOOM application, lecturers convey learning objectives, then remind that a sense of responsibility can generate imagination and courage to be more open to new, more creative ideas. This phase focus to train the indicators of scientific creativity such as Unusual Uses and Scientific Imagination. In phase 2 (Organizing creative learning needs) focus to prepare the indicators of scientific creativity such as Creatively Experiment Designing, Science Creatively Problem Solving, and Creatively Product Design. In phase 3 (Guiding the investigation) through the ZOOM application, lecturers guide students to develop a sense of responsibility to solve problems referring to student activity sheets and key student activity sheets. This phase focus to train the indicators of scientific creativity such as Unusual Uses, Problem Finding, Product Improvement, Scientific Imagination, Creatively Experiment Designing, Science Creatively Problem Solving, Creatively Product Design. In phase 4 (Establishing scientific creativity) focus to improve the students' scientific creativity through the ZOOM application. The lecturer asks students to relearn indicators of scientific creativity along with examples of test items listed in teaching materials, then give responsibility in making two points of scientific creativity tests and their solutions with indicators according to the division of group tasks. In phase 5 (Evaluation and Reflection) through the ZOOM application, the lecturer evaluates the scientific creativity and reflecting on their responsibilities during the process of learning.

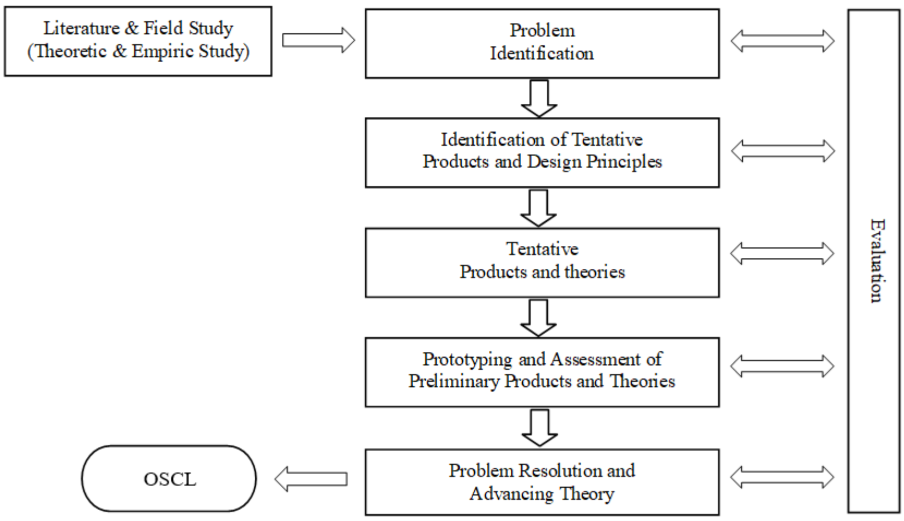
This research aims to produce an Online Scientific Creativity Learning (OSCL) for improving the students' scientific creativity in the Covid-19 pandemic. The research questions:

(1) How the validity and reliability of OSCL learning materials?

(2) How the effectiveness of OSCL learning to improve students' scientific creativity in Covid-19 pandemic?

Methods

This research is educational design research. The Wademen model was chosen to develop the OSCL (Plomp, 2007) with modifications including 1) problem systems, 2) tentative product and design principles, 3) tentative theory and products, 4) prototyping, and assessing products, and 5) improve product quality. Wademan's model was chosen because this model has advantages in terms of practicality and effectiveness to develop an innovative model that is novel and state of the art. Besides, researchers also developed OSCL-based learning tools presented in Figure 1.



(Adaptation: Wademan in Plomp, 2007)

Figure 1: Stages of Wademan model development (modification)

Populations were taken from 210 students at Universitas Negeri Surabaya and Universitas Lambung Mangkurat, Indonesia based on the Slovin formula (Sevilla et al., 1984). Sample of this research was conducted in 3 groups, namely OSCL (29 Student of Universitas Negeri Surabaya), CRBL (25 Student of Universitas Lambung Mangkurat), and Conventional Learning (29 Student of Universitas Negeri Surabaya), where these three groups are homogeneous. True Experiment with Randomized Subject Control-group Pre-test and Post-test Design is used in this research (Fraenkel et al., 2012).

T_1	E_1	T_2
T_1	E_2	T_2
T_1	C	T_2

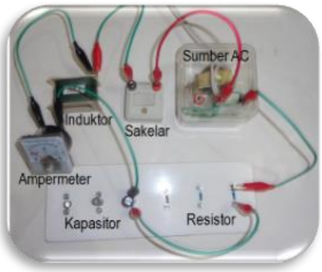
With = T_1: Pre-test, T_2: Post-test, E_1: OSCL, E_2: CRBL, and C: Conventional Learning

This research aims to produce an Online Scientific Creativity Learning (OSCL) for improving the students' scientific creativity in the Covid-19 pandemic. Apart from looking for the validity of the OSCL, this research also emphasizes the analysis of the effectiveness of OSCL, CRBL, and conventional learning. The quality of the OSCL learning tool was assessed by 2 experts using a validation sheet. Scientific creativity of students is measured using the Scientific Creativity Test instrument (SCTI) detailed in Table 2 and then analyzed through the homogeneity test, normality test, Paired t-test, N-gain and Independent t-test.

Table 2

Scientific Creativity Test Instrument (SCTI)

	Scientific Creativity Test Instrument (SCTI)
Problem 1: Unusual Uses	You are given three minutes. List as many scientific uses of a capacitor as you can think of. Don't stop writing until you are asked to stop. When asked to stop, put down your writing instrument and turn your answer sheet!
Problem 2: Problem Finding	You are given five minutes. Imagine a Philips lamp with power P connected to an AC source state power plant (i.e. PLN) and an inductor. The maximum amount of electric current flowing in the circuit is $I_{maks} = \frac{V_{maks}}{\sqrt{R^2_{Lampu} + X^2_L}}$, where $R_{Lamp} = \frac{P_{in\ lamp}}{V^2_{in\ lamp}}$. Write down as many problem formulas as you want for research. Don't stop writing until you are asked to stop. When asked to stop, put down your writing instrument and turn your answer sheet!
Problem 3: Product Improvement	You are given three minutes. List the possible repairs to an LCD (Liquid Crystal Display) projector so that It is easier to repair if it gets damaged. Don't stop writing until you are asked to stop. When asked to stop, put down your writing instrument and turn your answer sheet!
Problem 4: Scientific Imagination	You are given three minutes.An integrated Circuit (IC) is a combination of active and passive electronic components including hundreds or even millions of resistors and capacitors which are integrated into an electronic circuit in a small package. Imagine if IC has been used widely in everyday life, what would happen in this life! Don't stop writing until you are asked to stop. When asked to stop, put down your writing instrument and turn your answer sheet!
Problem 5: Creatively Experiment Designing	You are given ten minutes. Two inductors that are identical but different in shape are provided. Write an experimental plan to test which inductor is better? Don't stop writing until you are asked to stop. When asked to stop, put down your writing instrument and turn your answer sheet!
Problem 6: Science Creatively Problem Solving	You are given five minutes. Provided electronic components in the form of a reading lamp, inductor, capacitor, resistor, slide switch, and AC / DC source. Draw as many sequences as possible to make the reading light more versatile. Don't stop writing until you are asked to stop. When asked to stop, put down your writing instrument and turn your answer sheet!

Scientific Creativity Test Instrument (SCTI)	
Problem 7: Creatively Product Design	You are given ten minutes. Look at the test image of the RLC series below!  Describe a more secure and attractive experimental design of the RLC series circuit, then show the name and function of each part! Don't stop designing until you're asked to stop. When asked to stop, put down your writing instrument and turn your answer sheet!

(Ayas & Sak, 2014; Hu & Adey, 2010; Mukhopadhyay & Sen, 2013; Serway & Jewett, 2014; Siew et al., 2014; Suyidno et al., 2017; Walker et al., 2014)

To support the use of the SCTI, an assessment rubric was made. Rubric for assessing scientific creativity in this research is presented in Table 3.

Table 3

Rubric for assessing scientific creativity

Indicators of Scientific Creativity	Dimensions of Creativity	Criteria
1. Unusual uses 2. Problem finding	Fluency	Count all correct responses given. Each correct response is given a score of 1.
3. Product improvement	Flexibility	Counts the number of correct approaches given.
4. Scientific imagination 5. Science creatively problem solving	Originality	Tabulates the frequency of all the correct responses. The frequency and percentage of each response are calculated and the one with the smallest probability of response is chosen. If the
6. Creatively experiment designing	Originality	response probability is less than 5%, the score is 2; if the probability of 5 to 10% is given a score of 1; if the response probability is greater than 10% it is given a score of 0.
	Flexibility	Counts the number of correct approaches given.
7. Creatively product design	Originality	Give a score of 1 to 5 based on a holistic assessment.
	Flexibility	Each correct function is assigned a score of 1.

Findings

Validation Results

Table 4

The validity and reliability result of learning material and research instruments

Components	Construct Validity		Content Validity	
Online Lesson Plan of OSCL	Valid	Reliable	Valid	Reliable
Student Worksheet of Scientific Creativity	Valid	Reliable	Valid	Reliable
Student Learning Materials of Scientific Creativity	Valid	Reliable	Valid	Reliable
Online Learning Materials of Scientific Creativity	Valid	Reliable	Valid	Reliable
Scientific Creativity Test Instrument (SCTI)	Valid	Reliable	Valid	Reliable

Table 4 shows that OSCL Quality, Learning Materials, and Research Instruments which are reviewed from the aspects of construct validity and content validity are categorized as valid and reliable. The validity and reliability results of learning material and research instruments must be fulfilled. This is a prerequisite for the development research carried out in this research. The validation process was carried out by 2 science education experts in higher education. these two experts assessed the quality of the tools and instruments developed by the researchers. The validation results are presented in Table 4. These results are used as the basis for continuing at the implementation stage.

Scientific Creativity

The results of student scientific creativity using OSCL, CRBL, and Conventional Learning were analyzed in the form of pre-test, posttest, and N-gain including each indicator of scientific creativity are presented in Table 5.

Table 5

The results of the scientific creativity score

Group	Scores	Scientific Creativity Indicator							Scientific Creativity
		Unusual Uses	Problem Finding	Product Improvement	Scientific Imagination	Creatively Experiment Designing	Science Creatively Problem Solving	Creatively Product Design	
1 (OSCL)	Pre-test	1,91	0,03	1,76	1,71	0,14	1,80	1,42	1,25
	Post-test	2,75	3,01	2,77	2,91	2,56	2,86	2,43	2,76
	N-gain	**0,40**	**0,75**	**0,45**	**0,52**	**0,63**	**0,48**	**0,39**	**0,55**
2 (CRBL)	Pre-test	1,15	0,59	1,20	1,26	0,56	1,59	2,01	1,19
	Post-test	2,72	2,06	2,96	2,59	2,72	2,94	3,16	2,74
	N-gain	**0,55**	**0,43**	**0,63**	**0,49**	**0,63**	**0,56**	**0,58**	**0,55**
3 (Conventional Learning)	Pre-test	1,91	0,03	1,76	1,71	0,14	1,80	1,42	1,25
	Post-test	1,93	0,05	1,84	1,73	0,17	1,91	1,45	1,30
	N-gain	**0,01**	**0,01**	**0,04**	**0,01**	**0,01**	**0,05**	**0,01**	**0,02**

The results of students' scientific creativity using OSCL, CRBL, and Conventional Learning were carried out by parametric inferential statistical analysis (because the data met the requirements of homogeneity and were normally distributed) are presented in Table 6.

Table 6

Paired t-test of scientific creativity owned by students

Group	N	Paired t-test				
		Mean	Std, error mean	T	df	p
1 (OSCL)	29	-1,50	0,35	-22,86	28	0,00
2 (CRBL)	25	-1,54	0,43	-17,98	24	0,00
3 (Conventional Learning)	29	- 0,05	0,13	-1,95	28	0,00

To find out more effective learning between OSCL, CRBL, and Conventional Learning in increasing (N-Gain) scientific creativity, it was tested using the Independent T-Test is presented in Table 7.

Table 7

Independent t-test of scientific creativity

Group (N-gain)	N	Independent t-test				
		Mean Difference	Std. error mean	t	df	p
1 (OSCL) & 2 (CRBL)	54	0,01	0,03	0,19	52	0,84
1 (OSCL) & 3 (Conventional Learning)	58	0,53	0,02	23,17	56	0,00
2 (CRBL) & 3 (Conventional Learning)	54	0,52	0,02	22,70	52	0,00

Discussion

The OSCL learning materials has been proven valid and reliable (i.e. Table 4) consists of Online Lesson Plan of OSCL; Student Worksheet of Scientific Creativity; Student Learning Materials of Scientific Creativity; Online Learning Materials of Scientific Creativity. In addition, The OSCL learning materials has also been declared as a novel by the validators. OSCL learning materials meet the latest needs during the Covid-19 pandemic, which is to provide online-based learning tools that can be used in distance learning in the Universitas Negeri Surabaya. Another positive result is a learning materials that is declared valid and reliable materials can support OSCL implementation to increase students' scientific creativity. It is proven in Tables 5 and 6 that there is an improvement in the scientific creativity of students. The results of this research are supported by the research findings of Dwikoranto et al. (2020), Pandiangan et al. (2017), Susantini et al. (2017), Susantini et al. (2016) stated that valid learning tools can improve learning outcomes.

Table 5 explains that in all groups (OSCL, CRBL, Conventional Learning) students' scientific creativity before learning is at a low level. The results of students' scientific creativity are at a high level after using OSCL and CRBL, while conventional learning is low. Implementation of OSCL to improve scientific creativity in phase 3: Guiding the investigation (OSCL); through the ZOOM application, lecturers guide students to develop a sense of responsibility to solve problems referring to student activity sheets and key student activity sheets (containing indicators of scientific creativity) includes: (1) Write down as many problem formulations as possible to investigate and isolate the problems to be selected for investigation; (2) Planning experiments; (3) Carry out the best possible experiment to get the correct data; (4) Analyze data and study various reference sources, especially teaching materials to find solutions to problems you want to solve accurately and deeply. In phase 3 (Guiding the investigation) through the ZOOM application, lecturers guide students to develop a sense of responsibility to solve problems referring to student activity sheets and key student activity sheets. This phase focus to train the indicators of scientific creativity such as Unusual Uses, Problem Finding, Product Improvement, Scientific Imagination, Creatively Experiment Designing, Science Creatively Problem Solving, Creatively Product Design. Phase 3 (OSCL) focuses on scientific investigation activities that are relevant to the research of Khan & Alotaibi, 2020; Mamun et al., 2020; Novo-Corti, et al., 2013; Widodo et al., 2016; Yigit et al., 2014 found that investigations will activate students' scientific skills. In this third phase, students are strengthened by scientific creativity through investigations using a virtual lab. This is perfect for online learning in the Covid-19 pandemic. Students and lecturers do not meet directly but through the Zoom application. This can also reduce the transmission and spread of Covid-19, which until this article was written (19/10/2020) positive conditions in Indonesia are still increasing. Imagine if learning and experiments were forced using face-to-face, where students interacted directly and often students did not comply with the Covid-19 health protocol. The impact that will occur is a positive increase in the environment of the Universitas Negeri Surabaya and Universitas Lambung Mangkurat (research sites). The results of the latest research during the Covid-19 pandemic by Suryaman et al (2020) & Saputro et al (2020) stated that students responded positively to the experiment virtually during the Covid-19 pandemic.

The novelty of OSCL to increase scientific creativity through online learning in addition to phase 3 is also included in phase 4: Establishing scientific creativity (OSCL). Through the ZOOM application, the lecturer asks students to relearn indicators of scientific creativity along with examples of test items listed in teaching materials, then give responsibility in making two points of scientific creativity tests and their solutions with indicators according to the division of group tasks as follows: (1) Through the ZOOM application, the lecturer guides students in the best possible presentation of the ZOOM and asks students to give suggestions to other students who are presenting, (2) Through the ZOOM application, lecturers help students discuss material and examples of problems in teaching materials, especially those that are not yet understood. In phase 4 (Establishing scientific creativity) focus to improve the students' scientific creativity through the ZOOM application. The lecturer asks students to relearn indicators of scientific creativity along with examples of test items listed in teaching materials, then give responsibility in making two points of scientific creativity tests and their solutions with indicators according to the division of group tasks. This shows that after treatment in the OSCL and CRBL models it can improve scientific creativity (High level), while in Conventional Learning it is still at a low level. More specifically, OSCL (2.76 in high level) and CRBL (2.74 in high level). This shows that OSCL can be used to enhance scientific creativity. This finding is following the results of previous research (Suyidno et al., 2017; Zulkarnaen et al., 2017) that learning based on a valid scientific approach can increase students' scientific creativity. Besides, there is another support from the application of Vygotsky's scaffolding learning theory that students will be successful if they receive gradual guidance from lecturers through social learning.

Table 6 has shown that there is the same significance (N-gain at a moderate level) between OSCL and Creativity-Based Responsibility Based Learning (CRBL), except with conventional learning (N-gain at a low level). The OSCL has been proven effective in increasing students' scientific creativity during the Covid-19 pandemic. It is a novelty that OSCL can accommodate CRBL weaknesses that require face-to-face meetings to enhance scientific creativity. By using OSCL, lecturers can increase students' scientific creativity through online learning. The findings of this study are supported by Wicaksono et al. (2017) Virtual-based scientific learning can for improving the students' scientific creativity. The effectiveness of OSCL as online learning is also covered by the dual coding theory that learning using multiple representations will provide more experience than to students compared to conventional learning (Siswanto et al., 2018; Siswanto et al., 2018).

Conclusion and Implications

OSCL has 5 (five) online-based syntaxes, namely: Generating scientific creativity, Organizing creative learning needs, Guiding the investigation, Establishing scientific creativity, Evaluation and Reflection. The OSCL has been proven effective in increasing students' scientific creativity during the Covid-19 pandemic. There is no significant difference (N-gain at a moderate level) between OSCL and Creativity Responsibility Based Learning (CRBL), except with Conventional Learning (N-gain at low level). The results of students' scientific creativity are at a high level after using OSCL and CRBL, while conventional learning is low. OSCL can be an alternative for the scientific creativity of students in science education. Besides, OSCL facilitates the responsibility and science process skills which are characteristic of being emphasized in the learning phases. The OSCL can be a science learning innovation to improve student scientific creativity in the Covid-19 pandemic. In addition, OSCL can be an alternative digital learning solution in science education. The limitation of this research, it was only conducted on science (i.e. physics) learning, and the sample was only 83 students at Universitas

Lambung Mangkurat and Universitas Negeri Surabaya, Indonesia. For further research: (1) OSCL can be applied to science education with other levels of education such as elementary school, junior high school, and senior high school, (2) OSCL research-based gender at the elementary school, junior high school, and senior high school and higher education, and (3) applying OSCL to increase students' motivation in science education.

Acknowledgment

Researchers would like to thank Civitas Academic of Universitas Lambung Mangkurat, and Universitas Negeri Surabaya, and Universitas PGRI Semarang for supporting this collaborative research during the Covid-19 pandemic. Especially to Assoc. Prof. Dr. Sri Astutik and Assoc. Prof. Dr. Dwikoranto for providing advice on quality science learning tools. In addition, researchers appreciate the editorial board and reviewers at the Journal of Turkish Science Education who have provided suggestions for improving the quality of our articles.

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