MobLen Model for Enhancing Scientific Creativity of Physics Students: An Alternative in the Covid-19 Pandemic

Dwikoranto¹, *, B Jatmiko¹, E Hariyono¹, N A Lestari¹, B K Prahani¹, and Suyidno²

¹ Physics Education, Universitas Negeri Surabaya, Surabaya, Indonesia.
² Physics Education, Universitas Lambung Mangkurat, Banjarmasin, Indonesia.

*E-mail: dwikoranto@unesa.ac.id

Abstract. The development of scientific creativity (SC) is critical in physics education because students must have the improved-scientific-creativity to become superior graduates, including prospective physics teachers. Many prospective physics teachers lack scientific creativity. The focus of this research was to analyse the effectiveness of the MobLen model in increasing the scientific creativity of future physics teachers as an alternative to online learning models in the COVID-19 pandemic. This research used a pre-experiment design with one group pre-test and post-test of 62 prospective physics teachers. The data was collected using a scientific creativity test, then analysed using inferential statically with the Paired Sample Test and N-gain. The results showed that the MobLen model proved effective in increasing the scientific creativity of prospective physics teachers. This research implies that the MobLen learning model can increase the scientific creativity of prospective physics teachers as an alternative to online learning in the COVID-19 pandemic.

1. Introduction
Creativity involves producing something new or unusual that has value in the world. It also involves producing new and unusual ideas, and thinking of unique solutions to solve problems [1-5]. Creativity has four dimensions, namely the ability to generate a large number of ideas or problem solutions (fluency), the number of different categories of relevant responses (flexibility), the ability to generate new and original ideas (originality), and provide detailed and detailed responses systematic (elaboration). Creativity can also be viewed as a creative process, creative person, creative product, and creative environment. Scientific creativity includes the ability to generate new ideas or new products that are relevant to the context and have scientific uses [6-15].

The increasing development of the COVID-19 case in Indonesia has prompted the President to issue work and activities from home (WFH) policy. This WFH policy is related to the application of social distancing, which is considered the most effective way to prevent the spread of the coronavirus. The World Health Organization (WHO) has started using the term physical distancing or physical distance as a way to avoid the broader spread of the coronavirus. In addition, there is also a new policy, namely, social distancing. Social distancing or social distancing sounds like people need to stop communicating with each other. Instead, we must maintain as many communities as possible during physical distancing or physical distancing. WHO certainly has its reasons for changing the phrase social distancing to physical distancing. One of them is so that everyone can strengthen and relate to each other, even though they cannot physically be close together.
Universitas Negeri Surabaya responds positively to this by issuing policies related to lectures. The policy is stated in the Chancellor’s Letter Number B / 15254 / UN38 / TU.00.02 / 2020 concerning Prevention Measures for the Spread of COVID-19 in Universitas Negeri Surabaya. Therefore, researchers implemented the MobLen Model as an online lecture to increase students’ scientific creativity. The MobLen (Mobile Learning) model is implemented through on-line learning. The research problem that is to be resolved in this study is formulated as follows: How is the effectiveness of the MobLen Model in online lectures to increase the scientific creativity of Physics Department students of Mathematics and Natural Sciences Surabaya State University? The purpose of this research is to describe the effectiveness of the MobLen model in online lectures to increase the scientific creativity of students of the Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya. The benefit of this research is as reference material in improving the quality of graduates of the Physics Department of Mathematics and Natural Sciences, Universitas Negeri Surabaya. Also, it can be used as an alternative to innovative learning models in online lectures in the era of the COVID-19 pandemic.

2. Methods

This type of research was a pre-experimental study with a one group pre-test and post-test design [16]. The research subjects were students in the Physics Department of the Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya for the 2019/2020 academic year who took Integrated Science courses. The sampling technique used was purposive sampling. This technique was chosen because the COVID-19 pandemic condition causing learning activities to be not optimal, including undergraduate students from Physics Department for the 2019/2020 academic year who had to be served by their lecture activities. The research time was held from April to November 2020, while the research site was carried out in the Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya and the homes of each student. This choice of research location was taken with the consideration that the academic community is ready to accept and support the implementation of the MobLen model and student’s scientific creativity in general still needs to be improved. To collect data, before learning with the MobLen model, students were given a pre-test of student scientific creativity. After learning, students were given the same test (post-test). The instruments used in collecting data were Creativity Assessment Sheet, Scientific Creativity Test Instrument and Response Questionnaire Sheet. The research data in the form of pre-test and post-test scores were then tested using a series of prerequisite tests, namely: normality test and homogeneity test. The test results were then analysed using paired t-test to determine the differences in the pre-test and post-test scores. After there was a significant difference in the pre-test and post-test scores of scientific creativity, it was followed by calculating the mean level of increase in the pre-test and post-test scores using the normalized gain (N-gain) calculation.

3. Results and Discussion

The MobLen model effectiveness in the Integrated Science class in terms of increasing student creativity and response to the implementation of the MobLen model and its supporting devices in class A and class B are presented in the following tables (Tables 1-5).

A summary of the results of the creativity test before and after students taking the Integrated Science learning process in the real class is presented in Table 1.

| Class | Indicator Creativity | Pre test | Post test | N-Gain |
|-------|----------------------|----------|-----------|--------|
|       | Value | Completeness | Value | Completeness |
|       | Σ     | %    | Info | Σ     | %    | Info | <g> | Info |
| A     | Creative process  | 46.87 | 8 | 25.00 | TT* | 77.14 | 28 | 87.50 | T** | 0.58 | Moderate |
|       | Creative individual | 40.62 | 5 | 14.83 | TT* | 79.76 | 27 | 84.38 | T** | 0.68 | Moderate |
|       | Creative product   | 42.96 | 4 | 13.05 | TT* | 74.23 | 25 | 78.13 | T** | 0.56 | Moderate |
|       | Creative environment | 27.32 | 3 | 8.80 | TT* | 72.66 | 26 | 81.25 | T** | 0.64 | Moderate |
|       | Creative process   | 44.54 | 2 | 6.31 | TT* | 77.88 | 27 | 83.83 | T** | 0.63 | Moderate |
can improve student learning outcomes, especially Creativity Product and is reinforced by the data (Table 4) from the creativity questionnaire before and after learning.

Table 1 shows that the application of MobLen can increase the completeness of the creativity indicators in class A and class B, which are incomplete; because all indicators have been completed. The acquisition of the N-gain value shows the improvement level of each creativity indicator within the moderate criteria.

| Group | Indicator | Pre Test Value | Completeness | Post Test Value | Completeness | N-Gain |
|-------|-----------|----------------|--------------|----------------|--------------|--------|
| A     | Creative individual | 41.23 | 0 0.00 | 81.22 | 86.92 | 0.68 Moderate |
| B     | Creative product | 38.45 | 2 6.31 | 76.06 | 83.86 | 0.62 Moderate |
|       | Creative environment | 25.00 | 3 9.42 | 74.22 | 87.50 | 0.66 Moderate |

Information: T*** = Complete, TT* = Not Complete

Table 2. Paired t-Test Results

| N    | Mean | Standard Deviation | t   | Df | P*  |
|------|------|--------------------|-----|----|-----|
| 32   | -73.0| 12.7               | -32.4| 31 | <0.00 |
| 32   | -68.0| 15.3               | -31.0| 31 | <0.00 |

Information: p* <0.05 (two-tailed)

Table 2 shows the paired t-test result data in class A and class B of -73.0 and -68.0, respectively, with degrees of freedom (df) = 31; the t score of class A and class B respectively gave a value of -32.4 and -30.6 with a significance value of p <0.05. These results indicate a significant creativity increase in each class before and after the MobLen model applied. Data of students’ creativity were obtained from the assessment results of creative products produced by each group and the results of student creativity questionnaires. Students creativity data are presented in Table 3.

Table 3. Results of Student Creativity Product Assessment

| Group | Creative Product Indicator | 1 | 2 |
|-------|---------------------------|---|---|
|       | Value | Info | Value | Info |
| A     | Relevance to real needs   | 74.8 | B+ | 74.9 | B+ |
|       | Eligibility experimental equipment | 74.8 | B+ | 74.9 | B+ |
|       | Practicality of variable manipulation | 75.1 | B+ | 74.9 | B+ |
|       | Accuracy of data measurement | 75.2 | B+ | 74.9 | B+ |
|       | Practicality of data recording | 100.0 | A | 75.0 | B+ |
|       | Product aesthetics | 75.1 | B+ | 75.0 | B+ |
|       | Product safety | 75.2 | B+ | 75.0 | B+ |
|       | Product authenticity | 75.1 | B+ | 75.0 | B+ |
| B     | Relevance to real needs   | 75.3 | B+ | 75.0 | B+ |
|       | Eligibility of experimental equipment | 100.0 | A | 75.0 | B+ |
|       | Practicality of variable manipulation | 100.0 | A | 100.0 | A |
|       | The accuracy of data measurement | 100.0 | A | 75.0 | B+ |
|       | Practicality data recording | 100.0 | A | 75.0 | B+ |
|       | Product aesthetics | 75.2 | B+ | 100.0 | A |
|       | Product safety | 75.3 | B+ | 75.0 | B+ |
|       | Product authenticity | 100.0 | A | 75.0 | B+ |

Table 3 shows that the results obtained in Class A and Class B are not much different. Both classes receive a minimum score of B+. Moreover, there is another positive result, namely the existence of several aspects that scores 100.00. These prove that MobLen can improve student learning outcomes, especially Creativity Product and is reinforced by the data (Table 4) from the creativity questionnaire before and after learning.
Specifically, the reward potential was clearly to increase motivation and help teachers to influence the positively to the MobLen model and its learning process. The results of this study were in line with Jones [17], which reported that education utilizes the construction of reward and learning relationships. Specifically, the reward potential was clearly to increase motivation and help teachers to influence the

| Table 4. Completeness of Creativity Indicators |
|-----------------|-----------------|-----------------|-----------------|
| Class | Indicators of Creativity | Pre test | Post test | N-Gain |
| | | Value | Completeness | Info | Value | Completeness | Info | Info |
| A | Elaboration | 55.94 | 11 | 33.98 | TT* | 75.99 | 28 | 88.00 | T** | 0.47 | Moderate |
| | Originality | 52.93 | 5 | 16.00 | TT* | 72.93 | 27 | 83.98 | T** | 0.45 | Moderate |
| | Flexibility | 40.84 | 2 | 5.95 | TT* | 67.02 | 26 | 80.75 | T** | 0.44 | Moderate |
| | Fluency | 41.44 | 2 | 6.09 | TT* | 67.01 | 26 | 80.90 | T** | 0.42 | Moderate |
| B | Elaboration | 50.88 | 10 | 32.14 | TT* | 72.95 | 28 | 86.95 | T** | 0.45 | Moderate |
| | Originality | 50.92 | 6 | 19.05 | TT* | 70.22 | 27 | 82.78 | T** | 0.41 | Moderate |
| | Flexibility | 45.93 | 3 | 8.98 | TT* | 67.96 | 26 | 80.75 | T** | 0.42 | Moderate |
| | Fluency | 46.08 | 3 | 8.96 | TT* | 67.74 | 26 | 80.90 | T** | 0.44 | Moderate |

Information: T** = Complete, TT* = Not Complete

Table 4 shows that the application of MobLen in class A and class B can increase the completeness of creativity indicators, which previously had not been completed yet. It is reinforced by the acquisition of the N-gain value that the improvement level of each creativity indicator is in moderate criteria. A results summary of student responses regarding lecturers' novelty and clarity in teaching as well as their learning ease and the creativity formation in the Integrated Science course is presented in Table 5.

| Table 5. Student Responses |
|-----------------|-----------------|-----------------|
| Aspect | Class A | Class B |
| | Yes (%) | No (%) | Yes (%) | No (%) |
| Novelty | The way the lecturer teaches | 88 | 12 | 84 | 16 |
| | Language and content of handouts | 81 | 19 | 88 | 12 |
| | Learning atmosphere | 94 | 6 | 88 | 12 |
| Clarity of teaching | Motivate | 78 | 22 | 88 | 12 |
| | Organize | 75 | 25 | 81 | 19 |
| | Group investigations | 78 | 22 | 75 | 25 |
| | Facilitates creativity development | 72 | 28 | 78 | 22 |
| | Present and rate creative products | 84 | 16 | 75 | 25 |
| | Evaluation and reflection | 84 | 16 | 88 | 12 |
| Clarity facilitates | Material relevance | 81 | 19 | 84 | 16 |
| | Equipment eligibility | 88 | 12 | 88 | 12 |
| | for experiments | 91 | 9 | 91 | 9 |
| | Accuracy in measuring data | 84 | 16 | 91 | 9 |
| | Practicality in recording data | 91 | 9 | 84 | 16 |
| | Product authenticity | 88 | 12 | 94 | 6 |
| | Product aesthetics | 81 | 19 | 84 | 16 |
| | The relevance of matter to life | 78 | 22 | 84 | 16 |
| Ease of developing creativity | Equipment eligibility for experiments | 91 | 9 | 81 | 19 |
| | Accuracy in measuring data | 88 | 12 | 84 | 16 |
| | Practicality in recording data | 84 | 16 | 81 | 19 |
| | Product authenticity | 88 | 12 | 88 | 12 |
| | Product aesthetics | 88 | 12 | 94 | 6 |
| | Product safety | 81 | 19 | 75 | 25 |
| Ease of doing | Creativity Test 1 | 84 | 16 | 78 | 22 |
| | Creativity Test 2 | 72 | 28 | 75 | 25 |

Table 5 shows that at first most students of class A and B class felt new about the way the lecturer taught, the handouts manual/content, the learning atmosphere, lecturers' teaching clarity (the model phases, guiding the creative process, facilitating creativity development). Nevertheless, they found it easy to learn (applied creativity, developed creativity, do LP). Thus, students of class A and class B responded positively to the MobLen model and its learning process. The results of this study were in line with Jones [17], which reported that education utilizes the construction of reward and learning relationships. Specifically, the reward potential was clearly to increase motivation and help teachers to influence the
process and learning outcomes. Gadgets and games had a positive impact on the education world [18-24].

4. Conclusion
The MobLen model developed is effective because the student's creativity increases significantly in moderate criteria and students respond positively to the learning tools and processes (the way lecturers teach, the ease of learning) that has been conducted as an alternative to online learning models in the COVID-19 pandemic. However, it needs extensive testing for further research.

Acknowledgment
The authors would like to express appreciation for the funding for Department of Physics, Faculty of Science and Mathematics Universitas Negeri Surabaya, Indonesia to support this research.

References
[1] Saliceti F 2015 Procedia-Soc. Behav. Sci. 197 1174.
[2] Susantini E, Lisdiana L Isnawati, Al Haq A T, and Trimulyono G 2017 Biochem. Mol. Biol. Educ. 45 216.
[3] Widodo A, Maria R A, and Fitriani A 2016 J. Pengajaran MIPA 21 92.
[4] Yusnaeni, Corebina A D, Susilo H, and Zubaidah S 2017 Int. J. Instr. 10 245.
[5] Mukhopadhyay R 2013 J Humanit. Soc. Sci. 6 45.
[6] Park J 2012 J. Korean Assoc. Sci. Educ. 32 446.
[7] Raj H and Saxena D R 2016 Eur. Acad. Res. 4 1122.
[8] Rizqi, Prabowo, and Kirana T 2020 IJORER: Int. J. Recent Educ. Res. 1 1.
[9] Siew N M, Chong C L, and Chin KO 2014 Probl. Educ. 21st Century 62 109.
[10] Suyidno, Dewantara D, Nur M, and Yuanita L 2017 Adv. Soc. Sci. Educ. Humanit. Res. 100 98.
[11] Suyidno, Susilowati E, Arifuddin M, Misbah M, Sunarti T, and Dwikoranto D 2019 J. Penelit. Fis. Apl. 9 178.
[12] Usta E and Akkanat C 2015 Procedia-Soc. Behav. Sci. 191 1408.
[13] Wicaksono I, Wasis, and Madlazim 2017 J. Baltic Sci. Educ. 16 549.
[14] Zainuddin, Suyidno, Dewantara D, Mahtari S, Nur M, Yuanita L, and Sunarti T 2020 Int. J. Instr. 13 307.
[15] Zulkarnaen, Supardi Z A I, and Jatmiko B 2017 J. Baltic Sci. Educ. 16 1020.
[16] Fraenkel J R, Wallen N E, and Hyun H H 2012 How to design and evaluate research in education. (Boston: Mc Graw-Hill).
[17] Howard-Jones P 2011 Mind. Brain. Educ. 5 33.
[18] Novo-corti I, Varela-candamio L, and Ramil-diaz M 2013 Comput. Hum. Behav. 29 410.
[19] Siswanto J, Susantini E, and Jatmiko B 2018 J. Baltic Sci. Educ. 17 381.
[20] Siswanto J, Susantini E, and Jatmiko B 2018 J. Phys. Conf. Ser. 983 012034.
[21] Yigit T, Koyun A, Sinan A, and Arda I 2014 Procedia – Soc. Behav. Sci. 141 807.
[22] Alhalafawy W S and Zaki M Z T 2019 Int. J. Interact. Mob. Technol. 13 107.
[23] Yunita A, Nursechafia, Setiawan E, and Nugroho H 2018 Int. J. Interact. Mob. Technol. 12 96.
[24] Fawareh H M A and Jusoh S 2017 Int. J. Interact. Mob. Technol. 11 103.