The effectiveness of blended learning-based scaffolding strategy assisted by google classroom toward the learning outcomes and students' self-efficacy

Y Suryani1*, A R Ningrum1, N Hidayah1, N R Dewi1

1Universitas Islam Negeri Raden Intan Lampung, Indonesia.

*Correspondent author: yanisuryani@radenintan.ac.id

Abstract. This study was aimed to determine the effectiveness of a blended learning-based scaffolding strategy assisted by Google Classroom to improve students’ learning outcomes and self-efficacy in the Physics Lesson Planning course. This study employed the quasi-experimental method with one group pretest-posttest design. The samples of the study were 77 students of Physics Education, UIN Raden Intan Lampung in the academic year of 2019/2020. The instruments used were a questionnaire to investigate students’ responses toward the learning process, a questionnaire to measure students’ self-efficacy, and a test to measure students’ learning outcomes. The data were analyzed using descriptive analysis techniques, n-gain analysis, and effect size analysis. The results showed that the blended learning-based scaffolding strategy assisted by Google Classroom was effective in improving students’ learning outcomes with the n-gain and the effect size in medium category. The percentages of students’ self-efficacy in class A, class B, and class C were 68%, 60%, and 59% respectively. It was concluded based on the indicators of students’ learning outcomes improvement, students’ high self-efficacy, and students’ positive responses (84%). For further research, the researcher suggests to apply blended learning-based scaffolding strategy assisted by Google Classroom in other branches of science.

Keywords: Blended learning, google classroom, learning outcomes, self-efficacy, scaffolding strategy

1. Introduction

The 21st-century is marked by the rapid development of technology and information which is different from the previous century [1]. The developing technology is beneficial in leading toward a modern society by optimally utilized it in education [2]. The progress of Information, Communication, and Technology (ICT) is very important to be utilized optimally in the learning process, especially during the COVID-19 pandemic era. In this pandemic era, Information and communication technology (ICT) has become one of the alternatives for distance learning. This is in line with the circular letter issued by the Ministry of National Education No. 4 of 2020 concerning the implementation of the educational policy during the COVID-19 emergency period through the learning from home policy [3]. In this regard, the government requires teachers to utilize digital learning so that learning activities could be carried out from their respective homes.

Information, Communication, and Technology (ICT)-based education performs educational activities digitally or well-known as E-learning. E-learning has various advantages including the access that is not limited by distance, place, and time [4]. This is in line with previous research which stated
that the learning process through the E-learning model is very efficient to use in and out the classroom [5]. The lecture process is not limited by space and time where the students and lecturers can whenever and wherever do the learning process. Students can easily access material presented by the lecturers in the E-learning platform, and the interaction or communication between lecturers and students can be easily established.

Online learning can be done through various applications that can support the learning process such as Zoom, Google Meet, E-learning platforms, WhatsApp groups, Google Classroom, and so on [6]. Google Classroom has several features that can be used in the learning process including the main page that can display assignments, class preparation, and data storage on Google Drive. All of those features can be accessed via smartphones and can accommodate all types of files as well as profile pictures option. Furthermore, other features can be used by lecturers in developing learning materials, namely reuse posts, create questions, create assignments, and create topics [7]. Researchers utilized the Google Classroom to assist the students and lecturers during the learning process. Google Classroom can be integrated with various learning models so that it can be effectively used in learning during the COVID-19 pandemic [8].

Google Classroom can be said as one of the learning media that is based on inquiry learning methods because it can optimally involve students' abilities in finding, understanding, investigating, analyzing, and formulating learning outcomes [9]. In line with previous research, Google Classroom is also effective as learning media and is an approach to learning with the ability to transform higher quality education [10,11]. Besides, Google Classroom can also improve students' mathematical abilities [12].

In the classroom learning, it is common for students to experience difficulty in understanding the material presented by lecturers. Based on this, the researchers applied the scaffolding strategy assisted by Google Classroom as a learning media. Scaffolding can help students who experience learning difficulties. The scaffolding can be given directly by teachers or through computer assistance (digital) [13]. The accuracy of scaffolding is also based on the level of students' weaknesses so that it can help them understand the learning material. The results of research by [14,15] reveal that the students' scientific ability increased significantly after the application of E-scaffolding on physics courses. Students' ability and learning independence after the application of scaffolding strategy was higher than those who received direct learning strategy [16]. In its implementation, researchers applied the blended learning-based scaffolding strategy that combined face-to-face meetings and non-face-to-face meetings (online). Blended learning influences academic achievement and mixed learning environments [17,18]. Besides, researchers also utilized Google Classroom so it was expected to improve students' learning outcomes within the implementation of distance learning.

To help the students to achieve good learning outcomes, they are expected to possess high self-efficacy so they can master the concept well. Self-efficacy (the ability to control thoughts, feelings, and behaviors) is needed by students to motivate themselves in solving problems [19]. Lack of problem-solving skills results in low self-efficacy while high academic ability can improve self-efficacy [20]. Based on the description, it is important to see and know the effectiveness of a blended learning-based scaffolding strategy assisted by Google Classroom to improve students' learning outcomes and self-efficacy in the Physics Lesson Planning course. This study was aimed to determine the effectiveness of blended learning-based scaffolding strategy assisted by Google Classroom in improving students’ learning outcomes and self-efficacy in the Physics Lesson Planning course.

2. Research Method
This research was conducted at the Physics Education, Universitas Islam Negeri Raden Intan Lampung in the academic year of 2019/2020. The research employed a one-group pretest-posttest design. The data used in this study consisted of students’ learning outcomes, self-efficacy, and students’ response data on the learning process. The samples of the study were 77 students consisted of three classes (Class A, B, and C) which were taken from the entire population (all students in the academic year of 2017). The research instruments used were questionnaires and tests. The questionnaire was used to measure self-efficacy which consisted of magnitude, strength, and generality dimensions [21]. The measured
students’ responses toward the learning consisted of perceptions, interests, and responses regarding the conducted lectures. Besides, the students’ responses were also used to determine their responses toward the lecturer’s attitudes during the learning activities. The test was used to assess students’ learning outcomes. The tests consisted of pretest and posttest through Google Form.

The data analysis technique used to measure the level of self-efficacy was by adding up all scores from the questionnaires. Furthermore, the results were interpreted into certain categories based on the guidelines of the self-efficacy levels [21] as can be seen in Table 1.

Table 1. The Descriptive Analysis of Self-Efficacy Categories

| Interval       | Categories |
|---------------|------------|
| SE ≥ 81%      | Excellent  |
| 61% ≤ SE <81% | High       |
| 41% ≤ SE <61% | Fair       |
| 21% ≤ SE <41% | Low        |
| SE < 21%      | Poor       |

The data of students’ responses toward the lectures was analyzed by adding up the entire score from the questionnaire and then the percentage for each aspect observed was calculated. The effectiveness of the applied strategy was seen through the improvement of learning outcomes based on the categorization of n-gain values. The scores of pretest and posttest were analyzed using descriptive statistics by calculating the average gain value $\langle g \rangle$ to determine the effectiveness of the application of the blended learning-based scaffolding strategy assisted by Google Classroom. The gain value was calculated using the formula [22] that has been modified as follows:

$$\langle g \rangle = \frac{\langle S_f \rangle - \langle S_i \rangle}{S_{max} - \langle S_i \rangle}$$

Where $\langle S_f \rangle$ is the average posttest score, $\langle S_i \rangle$ is the average pretest score, and $S_{max}$ is the maximum score. The average gain value had been interpreted based on the modified criteria proposed by [22] that can be seen in Table 2.

Table 2. The Category of Average Gain Value

| Average Gain Value $\langle g \rangle$ | Categories            |
|--------------------------------------|------------------------|
| $\langle g \rangle > 0,70$           | High/Very Effective    |
| $0,30 \leq \langle g \rangle \leq 0,70$ | Moderate/Effective    |
| $\langle g \rangle < 0,30$           | Low/Less Effective     |

Then, analyzed using the effect size to see how much the effectiveness of a blended learning-based scaffolding strategy assisted by Google Classroom to improve students’ learning outcomes and self-efficacy using Cohen's. The calculation of the effect size uses Cohen's formula which is then interpreted based on the criteria according to [23] can be seen in Table 3.

Table 3. The Criteria of Effect Size

| Effect Size | Interpretasi |
|-------------|--------------|
| $d \geq 0,80$ | Large        |
| $0,50 < d \geq 0,80$ | Medium |
| $d \geq 0,50$ | Small        |
3. Results and Discussion
The blended learning-based scaffolding strategy assisted by Google Classroom had been applied to students’ learning outcomes and self-efficacy at Physics Education, Universitas Islam Negeri Raden Intan Lampung in the academic year of 2019/2020 on the Lesson Planning course. This course requires students, as prospective teachers, to design and plan the learning at schools in such a way. However, during the COVID-19 pandemic, the practical activities of designing and implementing learning designs had been transformed into online learning through Google Classroom. The following is the display of online learning features using Google Classroom.

![Figure 1. The Layout of Online Class](image)

Based on the research, the instrument to measure students’ self-efficacy on each dimension was administered with the following results.

| Dimension | Class A | Class B | Class C |
|-----------|---------|---------|---------|
| Magnitude | 60%     | 52%     | 47%     |
| Strength  | 84%     | 75%     | 75%     |
| Generality| 59%     | 52%     | 55%     |

![Figure 2. A Diagram of Each Dimension of Self-Efficacy](image)

Based on Figure 2, the average scores for the magnitude dimension in Class A, Class B, and Class C respectively with a quite high category. The magnitude dimension of self-efficacy defined the level of confidence to overcome learning and task difficulties [24]. Based on the category of self-efficacy, class A belonged to the excellent category, and class B and class C belonged to the high category. It
means that class A possessed higher stability and confidence in studying and completing assignments compared to class B and class C.

The average score of the dimension of generality which refers to the freedom of self-confidence in class A, class B, and class C were respectively with a quite high category. Based on the data, class A was higher compared to class B and class C. The overall average score of students’ self-efficacy that covers the dimensions of magnitude, strength, generality in class A, class B, and class C can be seen in Figure 3. This is in line with research conducted by [25,26] that show that e-learning and self-efficacy have positive impacts and are substantially related to the students’ perceived benefits and satisfaction which affect their intention to utilize E-learning. Good self-efficacy will affect the students’ level of physics problem-solving abilities [19, 27-29].

![Figure 3. Diagram of Students’ Self-Efficacy](image)

The researchers also distributed questionnaires for students to investigate their responses toward the lectures. Student responses measured their perceptions, interests, and responses toward the lectures. Also, the student responses were used to determine students’ responses toward the lecturer’s attitudes during lecturing activities. The data can be seen in Table 4.

**Table 4. Students’ Responses toward the Lecturing Process**

| No. | Observed Aspects                              | Class A | Class B | Class C | Average Percentage | Category  |
|-----|-----------------------------------------------|---------|---------|---------|--------------------|-----------|
| 1   | Students’ perceptions toward the learning activities | 91%     | 89%     | 82%     | 87%                | Excellent |
| 2   | Students’ interest in the lectures             | 86%     | 80%     | 74%     | 80%                | High      |
| 3   | Students’ perceptions toward the strategy implementation | 85%     | 83%     | 75%     | 81%                | Excellent |
| 4   | Students’ responses toward the lecturers’ attitudes | 93%     | 89%     | 79%     | 87%                | Excellent |
|     | **Average**                                   | 89%     | 85%     | 78%     | 84%                | **Excellent** |
Table 4 shows that the average percentage of students' responses from class A, class B, and class C toward the learning process was 84% and was categorized as excellent. Student responses for each aspect observed were positive. This was caused by the number of students who chose “agree” or “strongly agree” were more than students who chose “disagree” and “strongly disagree” with each questionnaire. Positive responses were obtained from the students who were enthusiastic in following the lecturing processes, both face-to-face and online lectures. There are more active students than passive students since many students asked questions and expressed their ideas during the group discussions, both in the face-to-face lectures and online meetings. This turned out to be in line with the results of research [30] that web-based learning implementation can improve students' ability to think smoothly through instructions given by the teacher. Students showed progress in working together, analyzing problems, and processing information [31].

The conditions of face-to-face and online classes were generally conducive. The students could access the learning resources provided by the lecturer anytime and anywhere. However, there was an obstacle that emerged during the online meetings in the form of technical difficulty due to a weak cellular signal experienced by the students who lived in remote areas. However, this problem can be overcome by scheduling the meeting in the morning starting from 08.05 AM to 09.45 AM. Furthermore, the researchers also measured the increase in students’ learning outcomes to see the effectiveness of the strategies and lectures by performing N-gain calculation as presented in Table 5 and the results of the effect size analysis can be seen in Table 6.

Table 5. Average N-gain Values

| Class  | Average N-gain | Category |
|--------|----------------|----------|
| Class A | 0.7            | Effective|
| Class B | 0.5            | Effective|
| Class C | 0.5            | Effective|

Table 6. Effect Size Values

| Class  | Effect Size | Criteria |
|--------|-------------|----------|
| Class A | 0.74        | Medium   |
| Class B | 0.57        | Medium   |
| Class C | 0.54        | Medium   |

Based on Table 5 and Table 6, it can be seen that the blended learning-based scaffolding strategy assisted by Google Classroom was effective in improving students’ learning outcomes. This is in line with the results of research [32] that the prospective teachers’ scientific explanation increased after the application of e-scaffolding in blended learning. Besides, web-based scaffolding helped high school students to develop evidence-based argument ability [33]. The scaffolding strategy also effective in increasing students' creative thinking abilities [13].

The scaffolding strategy also affected metacognition ability, self-efficacy, and learning achievement. Students with different cognitive styles achieved similar learning outcomes [34,35]. The blended learning activities are divided into two main activities, namely face-to-face learning activities in the classroom and online learning activities through Google Classroom. The applied blended learning activities are integrated with the scaffolding strategy. Students are divided heterogeneously into groups of 4-5 people. Students cannot go to the next learning phase if they have not been able to complete the previous learning phase. Face-to-face learning had been carried out from the first
meeting to the eighth meeting as well as to the midterm test. Face-to-face learnings were focused on group discussion activities that discussed the learning design theories, analyzed the process standards according to the national learning standards, analyzed basic competencies, formulated indicators and learning objectives, and assessed the completeness of the competencies. Then, the learnings were continued with non-face-to-face or online learnings by utilizing Google Classroom. The students were assigned to design the formats of online learning, ranging from preparing the syllabus and lesson plans, selecting media and learning resources, and assessment.

Lecturers act as facilitators and guide students in all online learning processes using google classroom. Through google classroom, teachers can discuss with students during the online learning process. In online learning, students are grouped into groups of 2 people and practice all learning designs that have been compiled by students. This is done to see student understanding and the suitability of the basic competencies that have been selected by students with learning media, learning resources, methods, learning models, and assessments. Furthermore, students work on assignments that have been prepared by the lecturer through the features available in google classroom. And in general, students can design and make learning assessments according to the basic competencies they choose.

Generally, the application of blended learning provided much broader opportunities for students to explore their abilities and independence which so far had been focused on in-class learning. Besides, blended learning also promoted interactions among students as well as interactions between students and teachers. The applied scaffolding strategy was well-received by the students based on the responses contained in Table 4. The implementation of learning was efficient in terms of time because the learning can be conducted independently by conducting online teaching and learning activities and discussing the materials that needed further explanation in the classroom.

4. Conclusions and Suggestions
Blended learning-based scaffolding strategy assisted by Google Classroom was effective in improving students’ learning outcomes and students’ self-efficacy in class A, class B, and class C respectively with the percentages of 68%, 60%, and 59%. It was based on the improvement of students’ learning outcomes, high improvement of self-efficacy, and the positive student’s responses. For further research, the researcher suggests that the blended learning-based scaffolding strategy is not only applied to physics education course material but can be applied with other branches of science.

References
[1] E. Y. Wijaya, D. A. Sudjimat, and A. Nyoto 2016 Transformasi Pendidikan Abad 21 Sebagai Tuntutan Pengembangan Sumber Daya Manusia di Era Global Pros. Semin. Nas. Pendidik. Mat. 1 263–278
[2] M. Fahrurrozi and M. A. Majid 2017 Pengembangan Model Pembelajaran Blended Learning Berbasis Edmodo dalam Membentuk Kemandirian Belajar Siswa Pada Mata Pelajaran Ekonomi Kelas Xi Ips Sman 1 Selong Tahun Pelajaran 2017/2018 JPEK (Jurnal Pendidik. Ekon. dan Kewirausahaan) 1 1 57–67
[3] Ujian Nasional 2020 C. d. 0.0075 300 300.
[4] Munir 2008 Kurikulum Berbasis Teknologi Informasi dan Komunikasi Journal of Chemical Information and Modeling 53 9 1689–1699
[5] Heru 2018 Pengembangan multimedia game pembelajaran matematika SMP J. Math Educ. Nusant. Wahana Publ. Karya Tulis Ilm. Di Bid. Pendidik. Mat. 4 1 1–14
[6] I. Suhada, T. Kurniati, A. Pandu, and M. Listiawati 2020 Pembelajaran Daring Berbasis Google Classroom Mahasiswa Pendidikan Biologi Pada Masa Wabah Covid-19 Digit. Libr. UIN Sunan Gunung Jati 1–10
[7] T. Favale, F. Soro, M. Trevisan, I. Drago, and M. Mellia 2020 Campus traffic and e-Learning during COVID-19 pandemic Comput. Networks 176 107290
[8] B. Mulatsih 2020 Penerapan Aplikasi Google Classroom, Google Form, Dan Quizizz Dalam Pembelajaran Kimia Di Masa Pandemi Covid-19 ideguru J. Karya Ilm. Guru 5 1 16-26
[9] A. Ghofur 2018 Using Google Classroom on Inquiry Based Learning To Improve Students ' Learning Participation J. Penelit. Pendidik. 10 2 1503–1509
[10] Abd. Syakur, Sugirin, and Widiarni 2020 The Effectiveness of English Learning Media through Google Classroom in Higher Education Britain Int. Linguist. Arts Educ. J. 2 1 475–483
[11] S. Sukmawati 2020 Implementasi Pemanfaatan Google Classroom Dalam Proses Pembelajaran Online di Era Industri 4.0 J. Kreat. Online 8 1 39–46
[12] Wulandari, M. H. Harijadi, Jumadi, I. Wilujeng, and H. Kuswanto 2019 Improving Mathematical Representation Ability of Student’s Senior High School by Inquiry Training Model with Google Classroom J. Phys. Conf. Ser. 1233 012043
[13] N. Nurul'sari, Abdurrahman, and A. Suyatna 2017 Development of soft scaffolding strategy to improve student’s creative thinking ability in physics J. Phys. Conf. Ser. 909 012053
[14] E. Oktavianti, S. K. Handayanto, Wartono, and E. Saniso 2018 Students’ scientific explanation in blended physics learning with E-scaffolding J. Pendidik. IPA Indones. 7 2 181–186
[15] N. Monjelat, L. Méndez, and P. Lacasa 2017 Becoming a tutor: student scaffolding in a game-based classroom Technol. Pedagog. Educ. 26 3 265–282
[16] E. Nurhayati 2017 Penerapan Scaffolding Untuk Pencapaian Kemandirian Belajar Siswa J. Penelit. Pendidik. dan Pengajaran Mat. 3 1 21–26
[17] V. K. Ceylan and A. Elitok Kesici 2017 Effect of blended learning to academic achievement J. Hum. Sci. 14 1 308–320
[18] M. Gladkova, L. Ilyashenko, M. Kutepov, Z. Smirnova, and O. Vaganova 2019 Development of communicative competencies of students in the context of blended learning Amaz. Invest.ig. 8 18 313–322
[19] Wulantri, I. W. Distrik, a. Suyatna, and U. Rosidin 2020 The Effectiveness of Creative-Inquiry-Based Student Worksheet in Improving Physics Self-Efficacy and Problem Solving of Senior High School Students J. Phys. Conf. Ser. 1467 012036
[20] M. Tezer and G. Y. Aşıksoy 2015 Engineering Students’ Self-Efficacy Related To Physics Learning J. Balt. Sci. Educ. 14 3 311–326
[21] H. Hairida 2017 Pengembangan Instrumen Untuk Mengukur Self Efficacy Siswa Dalam Pembelajaran Kimia Edusains 9 1 53–59
[22] D. E. Meltzer 2005 Relation between students’ problem-solving performance and representational format Am. J. Phys. 73 5 463–478
[23] L. A. Becker, “Effect size ( ES ),” 2000.
[24] S. Hastuti Noer 2012 Self Efficacy Mahasiswa Terhadap Matematika Makalah pada Seminar Nasional Matematika dan Pendidikan Matematika 10 802–808
[25] W. M. Al-Rahmi et al. 2018 Use of E-Learning by University Students in Malaysian Higher Educational Institutions: A Case in Universiti Teknologi Malaysia IEEE Access 6 14268–14276
[26] N. Valencia-Vallejo, O. López-Vargas, and L. Sanabria-Rodríguez 2018 Effect of motivational scaffolding on e-learning environments: Self-efficacy, learning achievement, and cognitive style J. Educ. Online 15 1
[27] A. Al Sultan, H. Henson, and P. J. Fadde 2018 Pre-service elementary teachers’ scientific literacy and self-efficacy in teaching science IAFOR J. Educ. 6 1 25–42
[28] N. Nuyami, M. Suastra, and M. Sadia 2014 Pengaruh Model Pembelajaran Kooperatif Tipe Think-Pair-Share Terhadap Self-Efficacy Siswa SMP Ditinjau Berdasarkan Gender J. Pendidik. dan Pembelajaran IPA Indones. 4 1

[29] D. D. Sagita, D. Daharnis, and S. Syahniar 2017 Hubungan Self Efficacy, Motivasi Berprestasi, Prokrastinasi Akademik Dan Stres Akademik Mahasiswa Bikotetik (Bimbingan dan Konseling Teor. dan Prakt. 1 2 43-52

[30] C. S. Lin and R. Y. W. Wu 2016 Effects of Web-Based creative thinking teaching on students’ creativity and learning outcome Eurasia J. Math. Sci. Technol. Educ. 12 6 1675–1684

[31] J. Y. Chao, P. W. Tzeng, and H. Y. Po 2017 The study of problem solving process of e-book PBL course of atayal senior high school students in Taiwan Eurasia J. Math. Sci. Technol. Educ. 13 3 1001–1012

[32] R. Amelia, I. Rofiki, H. Tortop, and J. Abah, 2020 Pre-service Teachers’ Scientific Explanation with e-scaffolding in Blended Learning J. Ilm. Pendidik. Fis. Al Biruni 9 1 33–40

[33] B. R. Belland, K. D. Glazewski, and J. C. Richardson 2008 A scaffolding framework to support the construction of evidence-based arguments among middle school students Educ. Technol. Res. Dev. 56 4 401–422

[34] N. Valencia-Vallejo, O. López-Vargas, and L. Sanabria-Rodríguez 2019 Effect of a metacognitive scaffolding on self-efficacy, metacognition, and achievement in e-learning environments Knowl. Manag. E-Learning 11 1 1–19

[35] C. Hederich Martínez, O. López Vargas, and A. Camargo Uribe 2016 Effects of the use of a flexible metacognitive scaffolding on self-regulated learning during virtual education Int. J. Technol. Enhanc. Learn. 8 3to4 199-216