The Science Literacy Profile Based

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The Science Literacy Profile Based on Students' Creative Thinking Skill in the Time of Covid-19 Pandemic Using Blended Learning

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ABSTRACT

This study tries to describe students' creative thinking skills and creativity levels using blended learning. This research was conducted using a cross-sectional survey method to 70 students of State Madrasah *Aliyah* (Islamic State Senior High School) in Mataram. The result of the study shows that students with high creativity category were able to perform all the creative thinking indicators in comprehending the background and problem solving as in the correct concept. The students with the medium category did not show all indicators of creative thinking perfectly, less ability to answer systematically, and unable to mention the function of objects in their opinion. The students with low creativity categories showed an inability to write answers as in the right concept, were unable to make their own decision, and did not have a strong argument in expressing their opinion. The creativity development within blended learning shows that it can be a suitable alternative for teachers to perform the teaching process during the COVID-19 pandemic.

Keywords: *Blended learning, Creative thinking skill, Creativity, Science literacy.*

1. INTRODUCTION

The COVID-19 pandemic phase significantly influences learning activity in class. COVID-19 pandemic forces schools and colleges to deactivate their learning process temporarily [1]. The schools must shift the face-to-face learning system into an online learning system. Technical obstacles experienced in online learning, which are; (a) the students and teachers have somewhat low skills in operating computer; (b) the difficulty in time management to develop lesson material, to prepare the assessment, the low accuracy of assessment, and in submitting responses on online learning forum; and (c) the supporting facilities are not equally distributed, such as internet facility, the lack of internet credit, and the lack of adequate android smartphone [2], [3], [4].

One of the appropriate learning system alternatives during the pandemic is blended learning. It is a combination of face-to-face learning with online learning. Face-to-face learning is performed inside a classroom or laboratory guided directly by a teacher or a lecturer. In contrast, online learning is performed with the assistance of an internet network [5], [6], [7], [8]. Blended learning allows teachers and students to optimize studying time to access lesson materials easily [9]. The review of the previous study shows that blended learning may stimulate skill, creative attitude, and independence in learning even though they do not meet face-to-face directly with the teacher [9]. The advantages that can be utilized in blended learning are; (a) the students and the teachers do not depend on learning schedule or classroom; (b) the students can learn independently using lesson material that can be downloaded by themselves, (c) for the students who have not comprehended the lesson yet, then, they can make discussion in online or offline outside studying hour [1]. The students enjoy learning online, especially when they are asked to look for information and material resources from the internet because they will derive much information. This shows that blended learning is feasible to implement [5].

Based on interview results with the students and teachers in Mataram, Indonesia, there are many online learning applications proposed in the time of the COVID-

19 pandemic, such as e-learning, WhatsApp group, zoom meeting, Google Classroom, Google Meet, or Edmodo. Learning through online discussions can improve students' critical and creative thinking skills [10]. Even though learning occurs in unlimited space, blended learning may sustainably take place [11].

Creative thinking is a thinking skill to generate a new way [12], [13]. Creative thinking is a process to comprehend a problem to emerge new ideas. The result of this creative thinking is called creativity. Creativity will not emerge if there is pressure, limitation, and rigid rules in undertaking an activity [14]. Someone who has creative thinking tends to see something with a new perspective, utilizes his knowledge to solve the problems with new fresh ideas [15], [16]. In Indonesia, students' creative thinking skill is considered low. This is caused by some factors, such as curriculum scope being too broad and the way teachers teach is still conventional [17], [18]. Until now, learning conducted in the school has not been able to develop students' creativity skills [19]. The creative thinking process starts with the recall process, basic thinking, and creative thinking. Creative thinking skill contains fluency, flexibility, originality, elaboration, and evaluation elements [20], [21], [22]. The ability to think critically will lead to acquiring new insight, a new perspective, or a new way of understanding a problem [23].

Previously, research conducted by Rachmadtullah [24] indicates that using the Moodle blended-learning learning model in Elementary School Teacher Education students during the COVID-19 pandemic is effective and can be used as a network-based or online learning solution. In addition, research conducted by Mahaye [25] also shows that blended learning is effectively used in learning during the COVID-19 pandemic. Thus, the researchers consider that it is important to conduct an assessment of the learning process using blended learning conducted in the schools of Mataram City during the COVID-19 pandemic through this study. The result of this study is beneficial to determine the continuing policy decision of the appropriate learning process during the COVID-19 pandemic.

2. METHODS

This study used a cross-sectional survey method; a survey conducted one time at a given time. The purpose was to describe students' creative thinking skills by studying Physics through blended learning. The subject of the study was 35 students of Class XA and 35 students of Class XB in a State Madrasah *Aliyah* based in Mataram, Indonesia. So, the total sample was 70 students.

The stages of survey implementation consisted of: (a) preparation stage, in the form of arranging and validating instrument; (b) survey implementation stage, in the form of collecting data; (c) analysis stage, in the form of analyzing and studying the data to be concluded. The test instrument collected data on the students' creative thinking skills based on the creative thinking skills indicators. The indicators include fluency, flexibility, originality, elaboration, and evaluation [16], [26]. Based on the indicators, afterward, it was described into 14 sub-indicators. Three experts in Physics Science validated the instrument before it was used. Data were analyzed by calculating students' percentages based on fluency, flexibility, originality, elaboration, and evaluation skill indicators. Later on, the students' creative thinking skills are tabulated into high, medium, and low categories [27]. The score criteria for every category are presented in Table 1.

Table 1. Category of creative thinking skills

Score Criteria	Category
Score ≥ 77	High
58 ≤ score < 77	Medium
Score < 58	Low

3. RESULTS

3.1. Students' Creative Thinking Skill Based on Indicators

The percentages of students' creativity based on fluency, flexibility, originality, elaboration, and evaluation indicators are presented in Table 2.

Table 2. The percentage of students' creative thinking skills

Indicators	Class	Students Amount	Percentage (%)
Fluency	A	25	71.43
	B	20	57.14
Flexibility	A	27	77.14
	B	23	65.71
Originality	A	8	22.86
	B	6	17.14
Elaboration	A	26	74.29
	B	22	62.87
Evaluation	A	28	80.00
	B	23	65.71

Based on Table 2, the number of students who show fluency indicator is 25 people in class A and 20 people in class B. In the learning process through blended learning, fluency indicator was seen in the students' enthusiasm in asking the question and the ability to answer more than one question. In addition, the students had many solutions or ideas on a problem. Students were also fluently expressing their notions, able to give examples in the form of written communication. On top of that, students can provide many examples of verbal language and visual communication, such as in pictures or graphics.

The flexibility indicator was shown by 27 students in Class A and 23 students in Class B. The behaviors seen from the flexibility indicator were where the students were able to give various interpretations on a picture and story problem, apply a concept differently, and think about many ways to solve the problem.

The students who think originality was as much as 8 people in Class A and 6 people in Class B. In blended learning, original thinking skill was observed through students' ability to think of a problem-solving solution that other student had not considered, the student has not been able yet to ask in other ways, and did not try to think in other ways.

Elaboration skills were seen in as many as 26 people in Class A and 22 people in Class B. In blended learning, the behaviors seen from elaborative thinking were when the student was able to find the deeper meaning of a problem solution by performing detailed steps and when the students were able to complete other people's ideas by adding the notion.

Evaluative thinking skills were observed in as many as 28 people in Class A and 23 people in Class B. In classes with blended learning, the behavior seen in evaluative thinking was when the students were able to consider their perspective, prove the correctness of the answer delivered, make their own decision, have their strong argument on responding to the opinion, and account for it.

3.2. Students' Skill to Think Creative Based on High, Medium, and Low Category

The following is tabulation of students' creativity skills in all high, medium, and low creativity skills as explained in Table 3.

Table 3. Category on Students' Creative Thinking Skills

Category	Frequency	Percentage (%)
High	30	42.86
Medium	26	37.14
Low	14	20.00

3.2.1. Students with High Creativity

During the interview, students were enthusiastic about answering the problem orientation, problem formulation, and hypothesis on the problem conducted online. The students felt more understand of the Physics concepts being taught. Moreover, they think that online learning can add creativity to problem-solving, in which one problem can be solved in many ways.

Fluency indicator was seen by the students' answer in finding kinetic energy and potential energy pair from the ball descending on the checkered track. The distance between one swath with another swath was 1-meter in length, the ball mass was 2kg, and its mechanic's energy was the same in every position, which was 200 joules. The following is one of the students' answers on the high creativity category in fluency indicator. The students answered by writing 6 pairs of kinetic energy and potential energy calculated in every swath movement. Thus, the students obtain a score of 4 on the 0-4 scale. The students wrote problem solution steps with their unit. So does with the ball's condition and position. For instance, when the ball was on the top, the students explained that the ball was in a silent state and had not moved yet (E_k=0). When the ball was in the final position, the students explained that the ball's height was 0, the potential energy was 0, and the kinetic energy was maximal. This showed that the students understood the background of the problem and were able to solve it.

The flexibility indicator was seen when the students were asked to explain the function and the benefit of a bow. The way of an archer follows the principle of mechanical energy conservation law. When the bowstring is pulled, the potential energy will occur, where the tighter to pull the string, the further the arrow is launched. The students gave a complete answer on the function and benefit of a bow, so they were given a 4 score out of a 0-4 scale.

The originality indicator is shown from the students' ability to write new examples in the application of the law of conservation of mechanical energy in everyday life. All students can provide complete and correct answers and provide new examples other than those described by the teacher or in the book so that they are given a score of 4 on a scale of 0-4.

The elaborative thinking indicator was shown through students' ability to explain the answer of the case given, which was on the impact that would occur if the earth did not have gravity. They gave the answer and detailed explanation so that they were given a 4 score out of a 0-4 scale.

The evaluation indicator was shown from the students' ability to consider solution to a problem based on their perspective. For instance, students explain the differences between kinetic energy, potential energy, and mechanical energy. They gave an answer and detailed explanation of the difference of kinetic energy, potential energy, and mechanical energy so that they were given a 4 score out of a 0-4 scale.

3.2.2. Students with Medium Creativity

During the interview, the students felt comfortable and easy to solve the orientation problem that was given online. This is because the other friend could not cheat on their answer. Besides that, the students felt that blended learning was an exercise session for the computer-based national exam. Using two practice activities conducted, the students felt that they could comprehend the Physics concept and solve the Physics problem using various answer variations.

The fluency indicator could be seen from the students who answers four pairs of kinetic and potential energy if it was calculated in every swath movement. The students obtain 3 scores out of a 0-4 scale. The students also did not write the answer in sequence as it should be, and they only wrote the final unit after calculating it.

The flexibility indicator was seen when the students were asked to explain the function and benefit of a bow. The student wrote the original usage of a bow even though the question was the extraordinary usage of a bow. The student obtains 2 of a 0-4 score on the flexibility indicator.

The originality indicator was shown from students' ability to write a new example on the application of the principle of mechanical energy conservation in daily life. All of the students were unable to provide the correct answers. The example given by the students were already existed in the book or had been explained by the teacher. Therefore, the students had obtained a 0 score out of a 0-4 scale.

The elaboration indicator was shown through students' ability to explain an answer from the case given, which was the impact that will occur if the earth does not have gravity. The student was able to provide an answer to the question given, but it was not explained in detail. The student's answer was short so that they obtained 2 scores out of a 0-4 scale.

The evaluation indicator was shown from students' ability to prove the correctness of answers given. The student had been able to respond to the question given. Still, there was no explanation for the differences between kinetic energy, potential energy, and mechanical energy. They only wrote a formula, so that the students obtained 2 scores out of a 0-4 score.

3.2.3. Students with Low Creativity

During the interview, the students said that through online learning, they could not understand well the lesson material even though there were practice and group discussions.

The assessment result of the fluency indicator showed that the students could not find kinetic and potential energy pairs correctly. Therefore, the students obtained a 0 score out of a 0-4 scale. The assessment result of the flexibility indicator showed that students could not precisely answer the extraordinary usage of a bow. Thus, the students obtained a 0 score out of a 0-4 scale.

The assessment result of the originality indicator showed that the student was asked to write new ideas as much as possible in the application of the mechanical energy conservation principle in daily life. Aside from the long jump, all of the students were unable to answer the question, so they obtained a 0 score out of a 0-4 scale.

The assessment result of the elaboration indicator was shown when the students were requested to explain what will be happened if the earth did not have gravity. All of the students could not come up with an answer. The answer given was not enough and not appropriate with the correct concept. They obtained a 0 score out of a 0-4 scale.

The assessment from the evaluation indicators shows that all students could not make their own decision. They did not have a solid argument to respond to the opinion and could not account for the statement written. Therefore, the students obtained a 0 score out of a 0-4 scale.

4. DISCUSSION

Physics learning is learning related to abstract concepts [28]. Based on the test, the creativity indicator was seen from the way of students' answers toward the questions. There are three students' groups based on the category: high, medium, and low creativity. The students with high creativity were as much as 42.86%, medium creativity was 37.14%, and the low category was 20.00%. The percentage was derived by the score obtained by class XA and class XB in State *Madrasah Aliyah* 2 Mataram that have performed Physics learning through blended learning. This shows that students with high and medium creativity skills are more significant in number than the low category one [6], [18]. The higher the students' creativity, the studying achievement is getting improved [29]. A study by Kousoulas [30] shows a positive correlation between creative thinking skills (flexibility, originality, and fluency) and students' achievement. The research result also indicates a significant difference between students' creative thinking skills according to academic level [31].

The fluency indicator is an indicator that shows thinking fluency skills in writing answers [3], [20]. The students with a high category on fluency indicator were able to come up with six pairs of kinetic and potential energy. The answer given was also appropriate with the concept of energy conservation law, and they wrote a complete Physics unit. This shows that the students have high creativity and were able to comprehend a good problem-solving given. The students with the medium creativity category could also provide some notions of four pairs of kinetic and potential energy. Still, they did not write the Physics unit completely. Meanwhile, the students with the low creativity category were incapable of coming up with any pair of correct kinetic and potential energy. Students with high and medium creativity had good fluency. This case is in line with Jehad Turkey's [31] study that the students who have high creativity show high fluency. Conversely, the student who has low creativity shows insufficient fluency. The other research shows that students who apply fluency thinking in experiment class has been able to interpret article conclusion or connect concepts with a various perspective. They have fluency thinking ability so that it is enough for them to make a variety of interpretations of a picture, story, or problem and generate varied ideas [32].

The flexibility indicator shows the students' thinking skills by providing a different answer with the book or the teacher's explanation [6], [21], [26]. Flexible indicators are only shown by the students with high and medium creativity categories, while those with low creativity do not appear. Students with high creativity can come up with six extraordinary usages of a bow as requested. Students with medium creativity were only able to mention two extraordinary usages of a bow. Meanwhile, students with low creativity were unable to provide the correct answer. There is a significant difference in flexibility in talented students. Students, who have talent, were capable of providing many ways to solve the problem and applying a concept differently [31].

Originality is an indicator that shows the ability to express ideas differently from other people [17], [23], [33]. The original indicator is seen in students with high creativity category that can answer the question precisely and have new ideas and answers. In contrast, the student with medium and low creativity was unable to answer the question given. This is shown from the students' incapability to mention the application in the principle of mechanical energy conservation in daily life besides the long jump. This study result is similar to Sugiyanto et al. [34]. Students' originality is low, only 9% until 20%. Students have not been able yet to generate a new, fresh, or different idea.

Elaboration is an indicator that shows the ability to describe and add details to the answer [17] [23]. Elaboration indicators can be demonstrated by students with high and medium categories. Students with high creativity were able to provide a detailed answer according to the Physics concept; as for the students with medium creativity. They can come up with a good answer, but they do not explain it widely. In contrast, a student with low creativity cannot explain precisely, and the answer does not conform to the question. This finding is supported by the research result [14] that students' elaboration will be better if the teacher freed the student to think freely. In another research [16], students are able to elaborate on every teacher's question. Nevertheless, elaboration can be trained for students with high, medium, and low creativity.

Evaluation is an indicator that shows the ability to assess the correctness of a concept and fact [23], [33]. Evaluation indicators can be demonstrated by students with high and medium creativity categories. Students with high creativity were able to answer in detail according to the Physics concept, make their own decision, and have a strong argument. The students with the medium category can come up with a good answer and make their own decision, but they were still in doubt. While all students with low creativity categories were incapable of making their own decision, they cannot make a strong argument on the opinion delivered and unable to be accounted for the statement written. This is supported with the research result [22], [27] that students are able to conclude themselves and evaluate the argument delivered.

The research study shows that creativity indicators, i.e., fluency, flexibility, originality, elaboration, and evaluation, were seen from the answer given by the students. The students' number with the high and medium category is 80%, while the low category is only 20%. This shows that more students are developing in creativity than the one who does not develop through the blended learning process. Several previous types of research related to online learning have shown a positive result. Blended learning could improve students' participation in the learning process.

Learning using blended learning can improve students' creative thinking. Recently, the available information technology supported the learning process during the COVID-19 pandemic. Students who are required to limit direct learning communication must remain to study at home with the assistance of technology. Learning with blended learning can improve students' creative thinking [35]. The application of blended learning affects the score attained by students. As much as 32% of students obtain a very good score, 52% are optimum, and 16% are good [36].

Several positive benefits that can be utilized by the teachers from blended learning need to be developed widely. The teachers need to be trained to use technology and also trained to use a blended approach to achieve the expected learning objective. Motivation must always be given to students, even in the time of the COVID-19 pandemic.

5. CONCLUSION

The study results showed that learning Physics through blended learning can improve students' creative thinking. Students with the high creativity category show all indicators of creativity in understanding the background, solving problems according to valid concepts, and showing high enthusiasm during the learning process. Students with low categories do not show fluency, flexibility, originality, elaboration, and evaluation indicators. Students cannot answer systematically and are also unable to mention the function of objects with their ideas. The number of students categorized into the category of high and medium creativity is greater than the category of low creativity. This shows that there is a good influence on learning through blended learning. Teachers need to be trained to teach students through blended learning so that the learning process can still be carried out even during the COVID-19 pandemic.

AUTHORS' CONTRIBUTIONS

All authors conceived and designed this study. All authors contributed to the process of revising the manuscript, and at the end, all authors have approved the final version of this manuscript.

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