

# Problem-based Learning (PBL) Model with Reading Infusion Strategy to Improve 21<sup>st</sup> Century Skills of Students

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## ABSTRACT

This study aims to improve students' 21st-century skills in the material of linear equations of two variables. 21st-century skills are seen as essential for society in today's era, but based on preliminary studies, these skills have not been optimally trained in learning mathematics in the classroom. A quasi-experimental study with a pre-post control group design was conducted to apply the Problem Based Learning (PBL) learning model with a reading infusion strategy. The population of this study was students of class X Vocational High School in the Computer Network Engineering study program (TKJ), totaling 105 students with a purposively selected sample of 72 students. The research instrument is a descriptive test to measure critical thinking skills and creativity with a validity of 0.87 and reliability of 0.93, and communication and collaboration skills rubrics. The results showed that PBL learning with reading infusion strategy significantly improved critical thinking skills with a normalized gain value of 0.46, including the medium category. However, PBL with reading infusion was not significant in increasing creativity. Student creativity in the experimental class increased with a normalized gain value of 0.36, including the medium category. Based on the results of this study, there is still no way to practice the skills of making ideas and elaborating ideas. After implementing PBL learning with reading infusion, students' communication skills were in the sufficient category, and students' collaboration skills were in a good category. It can be concluded that the PBL learning model with reading infusion strategy significantly improves critical thinking skills and does not considerably increase creativity.

**Keywords:** *Problem Based Learning, Reading Infusion, 21st Century Skills.*

## 1. INTRODUCTION

The 21<sup>st</sup> century is very important to improve aspects in technology, global awareness, and entrepreneurship. For that, the existence of the creative world is needed. The aim is to improve knowledge and cognitive processes in the world of education. The 21<sup>st</sup> century is marked by the rapid development of science, technology, and information; these developments encourage changes in how people work and live.

21<sup>st</sup>-century skills emerge as a response to changing times. 21<sup>st</sup>-century skills are skills that provide opportunities for students to solve problems and do exceptional work [1]. 21st century skills demand creativity, persistence, collaboration and problem solving combined with reasonable teamwork in groups in order to solve a contextual problem.

The 2013 curriculum begins to implement 21st century learning-oriented learning. Says that 21st century learning is simply defined as learning that provides 21st century skills to students, namely 4C skills which include: 1) Communication, 2) Collaboration, 3) Critical thinking and Problem Solving, 4) Creativity and innovation as the characteristics of learning in the 21st century is that learning demands that students have problem solving skills [2].

The importance of practicing 21<sup>st</sup>-century skills in learning is also reinforced by the National Research Council, which explains that the primary purpose of science learning is to teach students to have several skills, including scientific skills and rational thinking, seeking and using knowledge, creating and producing and having communication and collaboration skills [3]. The Next Generation Science Standards also state that the purpose of science learning is to teach students to think critically, creatively, communicate and collaborate to solve life's problems [4]. Vocational High School (SMK) is a competency-based secondary education unit that aims to produce graduates ready to work. Therefore, the learning process in schools should emphasize mastery of concepts and explore the potential of students to have critical and creative thinking skills, communicate and collaborate that are useful in solving problems in the world of work.

Mathematics, as one of the subjects taught in schools, indeed aims to practice these skills as stated in the Minister of Education Regulation no. 69

(2013) that the core competence of Mathematics is to form Indonesian people who can solve problems. To be able to solve problems, of course, 21st-century skills are needed [5].

The results of this study indicate that the application of game-based learning can facilitate 21st-century skills [6]. This is evidenced by the percentage of students' critical thinking skill profiles reaching seventy percent, while for creativity, communication, and collaboration, the percentages are below twenty percent. Therefore, it is necessary to find other ways to practice the skills. Classroom learning should be able to train the skills from the start.

One alternative learning model that is considered capable of facilitating 21st-century skills of students is the problem-based learning model or Problem Based Learning (PBL). PBL is one of the innovative learning models suggested in the 2013 curriculum. stated that PBL is a learning model that uses problems as the beginning of learning, the problems used are usually unstructured real-world problems, demanding multiple perspectives [7]. Strong emphasis on self-directed learning, utilizing various sources of knowledge, students work in groups, interact, learn from each other (peer learning), and make presentations.

The PBL learning model is one of the learning models considered suitable for practicing problem-solving skills. To solve problems, students must first master the physics concepts they use to provide alternative solutions [8]. The process of knowledge formation and mastery of concepts requires sufficient time; this is a different obstacle in applying the PBL learning model. Yeo and Tan [9] stated that it takes quite a long time if learning is preceded by knowledge and concept formation activities and then applies PBL. Still, students also cannot directly solve problems without having prior knowledge.

Further explained that to overcome these obstacles, a redesign in the application of PBL is needed. argue that the initial knowledge or required problem-solving concepts can be overcome by creating knowledge [10]. This knowledge formation activity can be done by creating a situation where students interact to obtain information, such as holding online forums or providing reading material for students to read.

Forming knowledge can be done by applying strategies that can facilitate students to have initial knowledge before the learning process takes place, then a reading infusion strategy is given. reading infusion prepared students to participate in learning activities and facilitated class discussion activities. Through reading activities, students get information from what they read. Reading material is in the form of real phenomena that occur in everyday life and are related to mathematical concepts studied to provide an understanding used in solving problems[3].

Based on this explanation, we research implementing the PBL model with the Reading Infusion strategy to improve vocational school students' 21st-century skills (critical thinking skills, creativity, communication skills, and collaboration skills). However, due to the difficulty of obtaining test kits and conducting communication and collaboration skills tests, these skills were limited to knowing their profile in this study. The results of this study are ways to train the skills through the PBL model with the Reading Infusion strategy.

**2. RESEARCH METHOD**

This study aims to understand how the PBL model with the Reading Infusion strategy improves students' 21st-century skills. Based on the research objectives, the method used is a quasi-experimental

research design, namely pre-test post-test control group design.

The population in this study were all students of class X in the Computer Network Engineering expertise program at one of the State Vocational Schools in Gowa Regency; they are 105 students. The sampling of this research was carried out by purposive sampling technique, taking sample members from the population, which was carried out by considering the focal program that received in the curriculum.

There are 4 components that become the criteria for this research, namely (1) if student learning outcomes are effective in the good category, (2) student activities are in the active category in the learning process, (3) student responses to learning activities are in good category, and (4) the ability of teachers to manage learning is in the good category.

**3. RESULTS AND DISCUSSION**

This section contains an explanation of results and a discussion on the importance of the PBL model with a reading infusion strategy to improve students' skills. To find out whether the model can enhance the skills in Vocational High Schools can be seen in table 1

Table 1. Learning Outcomes Scores for Critical Thinking Skills and Learning Creativity

Statistik	Pre-Test	Post-Test
Sample size	72	72
Ideal Score	100	100
Maximum Score	88,00	100,00
Minimum Score	20,00	55,00
Average score	58,97	80,94
Score range	68,00	45,00
Gain	0,46	0,36

Based on table 1, it can be stated that of the 72 students given a pre-test before implementing the PBL with a reading infusion strategy, their learning outcomes generally tended to be very low, with an average of 58.97 from the ideal score. 100. The highest score is 88.00, and the lowest score is 20.00.

At the same time, the level of student learning outcomes given the post-test after applying the learning model generally was in the high category with an average of 80.94 from an ideal score of 100. The highest score was 100.00, and the lowest score was 55.00.

**Table 2. Scores on Learning Outcomes for Critical Thinking Skills and Learning Creativity**

Interval	Categori	Pre-Test		Pos-test	
		Frekuensi	Presentase (%)	Frekuensi	Presentase (%)
0 – 60	Very low	32	44,4	3	4,16
61 – 70	Low	17	23,61	7	9,72
71 – 80	Medium	13	18,05	35	48,61
81 – 90	High	10	13,88	15	20,83
91 – 100	Very high	0	0	12	16,66
Total		72	100	72	100

Based on table 2, the overall score of student learning outcomes in the pre-test is in the very low category with a percentage of 44.4% and the low category with a percentage of 23.61%. This shows that students' initial ability in the before implementing the PBL model with the reading infusion strategy is low.

As for the post-test data, the students' learning outcomes scores with the highest percentage of 48.61% in the medium category as 35 students, in the high category 15 students, and the very high category 12 students. This means that the final ability of students in the after implementing the PBL model with a reading infusion strategy is in the medium category with an average score of 80.94. Thus, it can be concluded that student learning outcomes with the Problem Based Learning (PBL) model with a descriptive reading infusion strategy meet the effectiveness criteria.

The results show that the implementation of PBL learning with a reading infusion strategy significantly improves critical thinking skills with a normalized gain value of 0.46 as the medium category. However, PBL with reading infusion did not increase creativity. Students' creativity in the experimental class increased with a normalized gain value of 0.36, including the medium category. Based on the results of this study, there is still no evidence that PBL can improve the skills of making ideas and elaborating ideas. After implementing PBL learning with reading infusion, students' communication skills are in the medium category, and students' collaboration skills are in the excellent category. The PBL model with reading infusion strategy significantly improves critical thinking skills and does not considerably increase creativity.

Student learning outcomes by implementing the PBL model with a descriptive reading infusion strategy met the effectiveness criteria. The results of this study also show that the mathematics learning outcomes of students who are taught using the model meet the effectiveness criteria in terms of the level

of students' critical thinking skills, and students' creativity is in a high category with a classical mastery level reaching 78.8%, there were 27 of 72 students who got a score of 75, as well as the average value of the mathematics learning outcomes test which was measured through the pre-test before and after the test using the learning model experienced a significant increase.

Students are more active in critical thinking to understand the material taught through group-oriented learning techniques wherein groups are given several problems. They must discuss looking for information about solving these problems after they systematically collect problem-solving information. And scientifically, students' knowledge can be more constructed to understand the essence of solving the problem.

Overall the PBL model with a reading infusion strategy in understanding SPLDV material can improve critical thinking skills; this is shown in the normalized gain classification that student learning outcomes are in the fairly high category.

#### 4. CONCLUSION

1. Applying the PBL learning model with the reading infusion strategy significantly improves students' critical thinking skills.
2. Applying the PBL learning model with the reading infusion strategy is not significant in increasing students' creativity.
3. After applying the PBL learning model with the reading infusion strategy, the student's communication skill profile meets the sufficient category. Skills in using written communication skills in various contexts and forms meet the sufficient category, using multiple types of media and technology meet the sufficient category.

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