Improving the Problem-Solving Ability of Prospective Elementary School Teacher Candidates Through Blended Project-Based Learning

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Abstract. This research aims to improve the problem-solving ability of prospective elementary school teacher candidates through project-based blended learning. This problem-solving ability is very important for prospective elementary school teacher students to have. The ability to solve problems in everyday life is indispensable in this global era. This type of research is a quasi-experimental research design. The subjects of this study were students in grades A6 -21 and A7–21 of the UPY PGSD study program who were taking Mathematics courses. The data collection instrument used a problem-solving ability test question. The data analysis technique used t-test and N-Gain. Based on the results of data analysis, it can be concluded that project-based blended learning can improve the problem-solving ability of prospective elementary school teacher students. The results of the t-test showed that the value of t arithmetic = 2.793 > t table = 1.998 means that there is a significant difference in problem-solving abilities between students who take project-based blended learning and students who take regular online learning. The results of the N-Gain test show that the experimental group has a score of 0.61 which is in the medium category, and the control group has a score of 0.27 which is in the low category.

Keywords: improve · ability to solve problems · blended learning

1 Introduction

The COVID-19 pandemic, which had not subsided in early 2022, forced lecturers to change the management of their learning. Following the development of the industrial revolution 4.0 era, it demands a change in learning output. One of the learning outputs that prospective elementary school teacher students must have is the ability to solve problems [1]; [2]; [3]; [4]. The ability to solve problems to achieve a solution to a problem problem-solving skills are needed by students in mathematics courses because they correlate with everyday life, this ability can be seen through students' understanding both in choosing strategic procedures and their application [5]; [6].

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Something can be considered a problem if it has challenges and cannot be solved in a structured and correct manner by someone [7]; [8]. Mathematical problems can be distinguished based on (1) the purpose of the problem and (2) the number of answers. Based on the objectives, the problem is divided into two, namely the problem to find, and the problem to prove [9]. Based on the number of answers, the problem is divided into two, namely closed problems and open-ended problems [10]. Closed problems have only one answer, while open problems have more than one answer.

Based on observations made by researchers, it is known that prospective elementary school teaching students in the PGSD Study Program, Universitas PGRI Yogyakarta have several problems, including students who are faced with a problem or students are unable to find a solution to a problem they are facing. From the results of observations, it is also known that students do not understand the problem, so that what is asked on the question cannot be solved properly. In carrying out the strategy students can only carry out what they know in solving problems, so students are not able to draw conclusions on the questions. In mathematics courses in the PGSD UPY study program, of course, students must be able to use principles or procedures correctly and make the right choices in solving mathematical problems, especially in everyday problems. This is in accordance with the results of observations made, it appears that students have difficulty in solving problems, especially in story questions, students are not able to write down the information contained in the questions, are unable to plan the next steps and are unable to use procedures correctly so that they are not in accordance with the results of the answers. Which are desired. From this explanation, it can be formulated that problem solving ability in solving story problems is a very important ability so that with this ability students are able to seek solutions to the problems they face.

2 Method

This type of research is a quasi-experimental research design. The study subjects were students of grades A6 -21 and A7–21 of the UPY PGSD study program who were taking Mathematics courses. Class A6–21 as an experimental class that implements project-based blended learning and class A7–21 as a control class with regular online learning. The data collection instrument in this study used a problem-solving ability test. While the data analysis technique in the study used t-test and N-Gain.

3 Results and Discussion

Based on the results of the study, it is known that the level of achievement of student problem-solving skills is known. The percentage of achievement of each indicator can be seen in Table 1.

Based on Table 1, it is known that the achievement of each Problem Solving Skills Indicator is more than 70% which is in the high category. In the indicator of understanding the problem, the average percentage of achievement is 77.50% so it can be classified in the high category. Furthermore, the second indicator of analyzing this problem is the skill in relating the reciprocity (cause and effect) of existing problems [11]. Achievement The second indicator is 75.25% in the high category.The third indicator is planning alternative

Table 1. Achievement of Problem Solving Skills Indicators

Indicator of Problem Solving Skills	Achievement Percentage	Category
Understanding the problem	77,50	high
Analyze the problem	75,25	high
Planning alternative problem solving	74,75	high
Implementing a troubleshooting plan	76,25	high
Conduct an evaluation of the problem solving carried out	71,75	high

Table 2. Comparison of Problem Solving Ability between Control Group and Experiment Group

Class	Pre Test	Post Test	Gain	N gain	Criteria
Experiment (A6–21)	63,25	85,75	22,50	0,61	medium
Control (A7–21)	64,75	74,50	12,25	0,27	low

problem solving including skills in making connections between knowledge possessed with alternative problem solving to be designed, as well as planning approaches and strategies to solve problems [12]; [13]. The third indicator of achievement of 74.75% is in the high category.

The fourth indicator is implementing alternative solutions to this problem which is intended to be seen on the skills of carrying out the planned problem-solving flow.This fourth indicator got the achievement of 76.25% which was in the middle and high category. The fifth indicator is to evaluate the problem solving implemented in the form of skills in examining the efficiency of problem solving approaches, as well as responding to things that deviate from the plan [14]. This fifth indicator obtained an achievement of 71.75% which was in the high category.

Based on the results of the analysis of the problem-solving skills test, it is known that there are differences between the control group and the experimental group. Based on the results of the t-test on the pre-test value, it shows that the students' initial problem solving ability is obtained t count $=$ 1.372 $<$ t table $=$ 1.998 which means there is no difference in students' problem solving abilities before implementing project-based blended learning. While the t-test on the post-test results obtained the value of t count $=$ 2.793 $>$ t table $=$ 1.998 and (p) count $=$ 0 $<$ 0.05 which means HO is rejected, so that it can be concluded that there is a significant difference in problem solving abilities between students who take part in project-based blended learning with students taking regular online learning.

In addition to differences in problem-solving abilities, the impact of project-based blended learning is also an increase in students' problem-solving abilities before and after learning. The magnitude of the increase in problem-solving skills in class A6–21 which implements project-based blended learning and class A7–21 which carries out regular online Mathematics learning can be seen in Table 2.

Based on Table 2, it can be seen that there are differences in the increase in problem-solving abilities. Class A6–21 which implements project-based blended learning has an increase of 0.61 with moderate criteria which is better than Class A7–21 which uses ordinary online Mathematics learning which has an increase of 0.27 with low criteria. This happens because of the project-based blended learning process that is able to practice problem-solving skills [15];[16];[17];[18];[19]. The increase in problem-solving skills shows that project-based blended learning is effective in improving the problem-solving skills of prospective elementary school teacher students.

There are several relevant studies that examine students' mathematical problem-solving abilities that provide information as material for further research. Based on the research that has been described by [20], stated that with a percentage of 53% the steps that have been carried out are classified as lacking in mathematical problem solving abilities, namely understanding problems, planning for completion and re-examination at all stages that have been carried out. This is because (1) students in working on number operations are still confused which must be done first between multiplication or addition, (2) students in understanding basic concepts are meant to be less able to solve or work on problems as a whole, (3) students are less able in carrying out problem-solving steps and (4) material in other forms makes students less able to apply it in a real form. After that, the research described by [21] with the title Student Mathematical Problem-solving Ability Assessment concluded that making problem-solving ability questions could be done by means of one question containing all problem-solving characteristics or each indicator item was made in a separate question, while in this study The researcher made three questions, each of which had a problem-solving indicator.

Mathematical problem-solving ability is the ability of students to determine the outcome of a problem in the form of a math problem. Problem solving provides benefits for students in seeing the relevance between mathematics and other subjects. So the model that fits this result is project-based blended learning, because it is able to challenge students to analyze a problem. Project-based blended learning is a learning model that confronts students with a problem so that students can develop higher thinking skills and problem solving skills as well as gain new knowledge related to problems [22]; [23]; [24]. Therefore, project-based blended learning is very focused on solving problems. Because project-based blended learning can stimulate students to analyze problems and find results from mathematical problems. From the overall description above, it can be concluded that project-based blended learning can improve mathematical problem solving abilities in prospective elementary school teachers.

Solving problems is a form of thinking [25]; [6]. The ability to solve problems is not only related to the accuracy of the solutions obtained, but the ability shown since recognizing the problem, finding alternative solutions, choosing one alternative as a solution, and evaluating the answers that have been obtained. Problem-solving ability is considered the most complex intellectual function [26]; [27]. Problem solving can be started from recognizing the problem, finding alternative solutions, choosing alternative solutions, and doing problem solving, as well as reflecting on the success of problem solving. The ability to solve these problems can be developed by applying project-based blended learning. Project-based blended learning is an innovative learning, and emphasizes contextual learning through complex activities [28]; [29].

The focus of learning lies in the core principles and concepts of a discipline, involving students in problem solving investigations and other meaningful task activities, giving students the opportunity to work autonomously in constructing their own knowledge and reaching its peak to produce real products [30]; [31]. Project work can be seen as a form of open-ended contextual activity-based learning and is part of the learning process that places a strong emphasis on problem solving as a collaborative effort carried out in the learning process over a certain period [32]; [33]. Students in solving complex problems through projects, support the development of problem solving skills. Project work contains complex tasks based on very challenging questions and problems and requires students to design, solve problems, make decisions, carry out investigative activities, and provide opportunities for students to work independently [34]; [35].

4 Conclusion

Based on the results of data analysis, it can be concluded that project-based blended learning can improve the problem-solving ability of prospective elementary school teacher students. It can be seen from the value of t arithmetic = 2.793 > t table = 1.998 indicating that there is a significant difference in problem-solving abilities between students who take project-based blended learning and students who take regular online learning. The results of the Gain test showed that there was a difference in the increase in problem-solving ability where the experimental group had an increase of 0.61 with moderate criteria and the control group of 0.27 with low improvement criteria.

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