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The Influence of Project-Based Learning Model on Ability to Find Research Problems in Learning Strategy Courses

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Abstract

Teaching competence requires several skills in the form of real products or works, so in lectures Learning Strategies are very suitable for using the Project-Based Learning (PjBL) model. This study aims to describe the effect of using a project-based learning model on the ability to find problems. This research is a pre-experimental study and uses a single group design with pretest – treatment – posttest. The design steps are as follows: (1) Selecting a group of subjects for the sample, (2) Conducting a pretest, (3) Providing treatment, (4) Providing a posttest after treatment, (5) Finding the average score and standard deviation, both from pretest and posttest compare the two, and (6) test the average difference. The subjects of this study were second semester students of the Department of Biology Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang who took part in the Learning Strategy course (38 students). Data collection techniques were carried out by pretest and posttest. The research instruments used were pretest and posttest questions, and rubric sheets to assess students' assignments in finding problems. Data analysis for knowledge was performed by paired t test. Based on the results of the analysis, it shows that tcount > ttable (31.78 > 2.02619), which means that there is a significant difference, so that the development of the PjBL model has an effect on the ability to find research problems in the Learning Strategy course.

Keywords: Ability to find problems; PJBL models; Learning strategies

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INTRODUCTION

The Learning Strategy course is a course that equips students in organizing learning. The specified Course Learning Outcomes (*Capaian Pembelajaran Matakuliah*/CPMK) are students able to determine (C5) approaches, models, strategies, methods and techniques in effective learning, are skilled at designing and demonstrating (P5, A4) active and innovative learning in order to develop the attitudes, values and abilities of participants students and skilled at making (P5) research problem formulation based on learning strategies. From the CPMK it appears that this course aims to shape student competence in teaching, starting with producing real products or work. Real products or work in the Learning Strategy course in the form of active and innovative learning designs, as well as formulation of research problems. With the ability to design active and innovative learning, students are expected to be sensitive to problems related to learning strategies (Chamisijatin, 2022; Firdaus et al., 2023).

The CPMK must be achieved by students so that they can be said to be complete or successful in learning. Considering that teaching competence requires several skills in the form of real products or work, the Learning Strategy course is very suitable for using the Project-Based Learning (PjBL) model. PjBL is a model that emphasizes students to be able to

learn independently by solving problems encountered and students can also produce a real project or work (Biazus & Mahtari, 2022; Rati et al., 2017). The PjBL model is a learning model that focuses on student ideas, namely forming a separate picture of relevant topics or events and issues that are in accordance with the experiences possessed by these students in everyday life, thus providing opportunities for students to work independently. autonomously construct their learning and later be able to produce valuable and realistic student work products (Yanti et al., 2012). On the other hand PjBL is defined as a teaching that tries to link technology with everyday life problems that students are familiar with, or with school projects. (Harun, 2020; Lely et al., 2020; Sumarni & Kadarwati, 2020; Turcotte et al., 2022). PjBL is one model of anticipation to develop the potential of students, especially their soft skills (Amrozi, 2018; Effrisanti, 2015). The PjBL model is a learning model whose learning process is directed at activating learners to build knowledge and skills as well as values as well as attitudes through direct experience. (Wagirun & Irawan, 2019), included in problem solving.

A problem is something that has to be solved (Carson, 2007; Nickles, 1981). Problem is a statement about circumstances that are not as expected. The problem is when the reality that occurs or reality, the facts are not as expected. Problem something that needs to be solved or solved. Problem solving is the ability to analyze problems and find effective solutions to solve these problems. Problem solving ability must be owned by every learner. Because the ability to solve problems is an essential and fundamental ability. That is, problem solving ability is a fundamental or very important ability (Rahayu & Afriansyah, 2015).

PjBL starts with a problem, then students deepen their knowledge of what they already know and what they need to know to solve the problem (Hmelo-Silver, 2004; Rahmawati, 2020; Sari et al., 2019). Students can choose problems that are considered interesting to solve, so that they are motivated to play an active role in the learning process and in solving these problems students can make products or designs. This means that with the PjBL model, students will be honed in finding problems (Maryati, 2018).

Problem solving ability is closely related to critical thinking ability (Cahyono, 2016; Rachmantika & Wardono, 2019). From the characteristics of problem-solving abilities, it can be seen in the characteristics of (1) Recognizing problems, and (2) Finding ways that can be used to deal with these problems. So the ability to find problems is the beginning of students' critical thinking. Polya's problem solving steps are: (1) understanding the problem, (2) planning a solution, (3) implementing the plan, (4) re-examining (Akhsani & Jaelani, 2018; Yayuk & Husamah, 2020).

From this it appears that someone in solving a problem begins with understanding the problem. In the step of understanding the problem, the problem solver must be able to determine what is known and what is asked. This is what it means to find a problem. To make it easier for problem solvers, it is necessary to understand the problem and obtain an overview of the solution (Carson, 2007). This can be done by making important notes in the form of pictures, diagrams, tables, graphs or something else. By knowing what is known and asked, the problem-solving process will have a clear direction. Polya's move was found to be effective in problem solving. The ability to solve problems by implementing Polya steps is better than before implementing Polya steps. The pattern of student answers with Polya's steps is more varied compared to the application of ordinary learning (Agustina & Umar, 2020).

This is also supported by the results of previous research that the PjBL model has a significant effect on the ability to write geography scientific papers for high school students (Baidowi et al., 2015). Scientific work is in the form of real student products or work that begins with the discovery of problems (Chin & Osborne, 2008; Severinghaus, 2016). The PjBL model is very good for developing self-confidence, increasing problem-solving skills, and getting students used to using higher-order thinking skills (Wagirun & Irawan, 2019). In addition, there is a significant effect of using the PjBL model on students' creative thinking

abilities and scientific performance (Marlnda, 2012). The PjBL model has never been applied to a Learning Strategy course. Thus, it is necessary to explore the use of the PjBL model in increasing the ability to find research problems based on Learning Strategies. Problem finding is the first step for students to solve problems. Finding problems is the beginning of students to think critically, meaning that when students find research problems based on learning strategies, it means that students understand innovative and creative learning in achieving learning goals (Birgili, 2015; Kurniawati, 2019; Lodge et al., 2018; Rahman, 2019).

This study aims to describe the effect of using a project-based learning model on the ability to find problems. The importance of this research really needs to be done because the world of education is being faced with the demands of 21st century skills, namely critical thinking, creativity, communication, and collaboration, so that the learning process must also be carried out by instilling competencies in students to welcome this era. Based on this, it can be seen that research is related to the application of project-based learning models in the ability to find research problems based on learning strategies. By knowing the effect of the PjBL model on the ability to find problems, it is hoped that it can illustrate the effectiveness of using this model in related courses.

METHOD

This research is a pre-experimental study and uses a single group design with pretest – treatment – posttest. This design step is as follows following the previous research (Rukminingsih et al., 2020): (1) Selecting a group of subjects for the sample, (2) Conducting a pretest, (3) Providing treatment, (4) Providing a posttest after treatment, (5) Finding the average score and standard deviation, both from the pre test and post test comparing the two , (6) Testing the average difference with the t test.

The research was conducted at the UniversitAS Muhammadiyah Malang, in the Learning Strategy course. The time of the research was conducted from March to December 2022. The population used in this study were students of the Biology Education Study Program, FTTE, Universitas Muhammadiyah Malang, class of 2021 who took part in learning strategy lectures. The subjects of this study were second semester students of Biology Education at the Universitas Muhammadiyah Malang who attended lectures on learning strategies. Because in this batch there was only one class with 42 students, the pre-experimental type was chosen, and the sample in this study used a population sample.

The type of variable in this study is the dependent variable in the form of students' ability to find problems and the independent variable in the form of project-based learning. Data collection techniques were carried out with pretest-posttest and task assessment rubrics. As for the form, as presented in Table 2. The research instruments used were pretest posttest questions, and rubric sheets to assess students' assignments in finding problems. Data analysis for knowledge was performed by paired t test.

RESULTS AND DISCUSSION

Activities that have been carried out from this research are: (1) designing research designs (designing project-based learning); (2) carrying out the learning process with pre-test and post-test in it and data collection, and (3) analyzing and testing the data.

Research design

Designing a research design, begins with designing learning. In designing learning, it is intended to design learning using Project-Based Learning. In designing this, it starts with making a competency map (learning analysis), and then making a Semester Learning Plan. The linkages from the needs of this research will be presented: (1) Competency maps (Learning Analysis) and Summary of the use of learning methods in achieving each Sub-CPMK (Table 1). From the competency map it is known that the learning stages passed by

Sub CPMK students who are understanding, analyzing, applying and finally are expected to be skilled at demonstrating and formulating problems. This stage is in accordance with the main requirements for using the PjBL model to develop the learning process in the classroom, namely: 1) Mastery and deepening of the material, and 2) Mastery of scientific skills (Tinenti, 2018). Thus, it is hoped that this design will lead to an effective use of the PjBL model.

Table 1. Summary of the use of learning methods in achieving each Sub-CPMK

Sub-CPMK	Method used
1. Understand the basic concepts of effective learning strategies and create learning frameworks.	Discussions, lectures, questions and answers
2. Analyze the application of learning theories in learning	Discussion
3. Define essential materials and create a concept map	Debate
4. Determine and design approaches, strategies, models, methods and learning techniques on theme 1	*Problem Based Learning* (PBL)
5. Determine and design approaches, strategies, models, methods and learning techniques on theme 2	*Problem Based Learning* (PBL)
Pre test	
6. Determine and design approaches, strategies, models, methods and learning techniques on theme 3	*Project Based Learning* (PjBL)
7. Skilled in designing and demonstrating active and innovative learning	*Project Based Learning* (PjBL)
8. Skilled in making research problem formulations based on learning strategies	*Project Based Learning* (PjBL)
Posttest	

Table 1 shows that the PjBL model is used in conjunction with other method models. The PjBL model will be used at the end of the learning activities, where previously the PBL model was used. This research will prove the effectiveness of the PjBL model in finding problems. For this reason, a pretest was carried out after several sub-CPMK using the PBL learning model. Furthermore, the CPMK sub will be achieved with the PjBL model, the results of which will be seen from the posttest. The pretest and posttest questions can be seen in Table 2.

Table 2. Pretest and posttest questions

Type	Question
Pretest	a. When studying viruses with material: (1) Characteristics of viruses: structure and reproduction, (2) Grouping of viruses, (3) Role of viruses in life, (4) Participation of youth in preventing the spread of HIV and other viruses. What problems might arise? How to solve the problem? b. The Basic Competencies of class XI Biology subjects are: 3.5 Analyzing the relationship between the structure of the organ-composing tissue in the locomotion system in relation to bioprocesses and functional disturbances that can occur in the human locomotion system 4.5 Presenting works on the use of technology in overcoming movement system disorders through literature studies Question: 1) Taking into account basic competence above, the most suitable learning model

Type	Question
	is Project Based Learning, determine the innovative activity steps of the PjBL. 2) Compare it with the PjBL Steps/Syntax that you have found, so that you will see the innovations you have made. 3) Demonstrate the innovation in research problems.
Posttest	a. When learning Class XII Cell Metabolism with material: 1. Enzymes (Components of enzymes, Enzyme properties, How enzymes work), 2. Carbohydrate Catabolism (Aerobic Respiration, Anaerobic Respiration), and 3. Anabolism (Photocentesis, Chemosynthesis). Write down the innovative learning syntax of the learning. What problems might arise? How to solve the problem? b. The Basic Competencies of class X Biology subjects are: 3.9 Grouping animals into phyla based on body layers, body cavity, body symmetry, and reproduction 4.9 Presenting a comparative report on the complexity of the animal body layers (diploblastic and triploblastic), body symmetry, body cavity, and reproduction. Question: 1) Taking into account basic competence above, the most suitable learning model is Project Based Learning, determine the innovative activity steps of the PjBL. 2) Compare it with the PjBL Steps/Syntax that you have found, so that you will see the innovations you have made. 3) Demonstrate the innovation in research problems.

The pretest and posttest questions are made different so as not to affect the results of the repeated posttest. The different pre-test post-test questions have the same cognitive level, namely C6 and P5. In contrast to the basic competence that will overcome the problem.

Carry out the learning process with pretest and posttest in it and data collection.

Based on the learning design that has been designed as in Table 2, learning is carried out as well as research data collection. Meetings 1-8 using Lectures, discussions, debates, assignments and Problem Based Learning (PBL) methods. After that, the Pre-Test was carried out. Next meeting 10-15 learning using PjBL. After that, the Posttest was carried out. The PjBL model is used to achieve 3 Sub CPMK with 2 group projects and 1 individual project. The steps/syntax used in the PjBL are as shown in Table 3.

Table 3. PjBL Activity Syntax/Steps

No	Step	Activity
1	Project determination	Together with student groups determine the theme/topic of the project
2	Designing project completion steps	The topic referred to here is the high school biology material, which learning innovations will be explored that are suitable for use in this material.
3	Preparation of project implementation schedule	Lecturers facilitate students to design steps for project completion activities and their management, for example: (1) Make a concept map, (2) Define material characteristics, (3) Determine approaches, models, strategies, and methods that are suitable for use in the material and provide the reasons, (4) Making learning innovations from material/topics, (5) Identifying problems that might arise in teaching material/topics.

No	Step	Activity
		(6) Make a research title of the problems that might arise and make a problem statement
4	Completion of projects with facilitation and monitoring of lecturers	Students set a schedule for when to complete each activity that has been set in Step 2.
5	Compilation of reports and presentation/publication of project results	Students search for or collect data/materials and then process them to compile/realize part by part until the final product is produced (in this project it is closer to studying literature).
6	Evaluation of project processes and results	The results of the project in the form of a report, presented in class

Perform data analysis from the pretest and posttest data that has been obtained. The following is the pretest and posttest data obtained to measure the ability to find research problems (Table 4).

Table 4. Data on pretest and posttest results

n	pre-test	post-test	Difference	T_{count}	t_{table}	note
38	55	89.157	34.157	31.78	1.075	significantly different

Based on the results of the paired t test analysis, it shows that t count is greater than t table, then Ho is rejected, so it can be concluded that there is a significant difference, so that pretest and posttest have significant differences. The results of the calculation analysis show that the development of a project-based learning model has an effect on the ability to find research problems in the learning strategy course.

PjBL has an effect on the ability to find research problems because in the PjBL model it starts with a problem (Jalinus & Nabawi, 2018; Launuru et al., 2021; Wardah et al., 2022). Furthermore, students deepen their knowledge of what they already know and what they need to know to solve the problem. Students can choose problems that are considered interesting to solve, so that they are motivated to play an active role in the learning process and in solving these problems students can make products or designs. That is, with the PjBL model students will be honed in finding problems.

The PjBL model is a learning model that focuses on student ideas, namely forming a separate picture of relevant topics or events and issues that are in accordance with the experiences possessed by these students in everyday life, thus providing opportunities for students to work independently. autonomously construct their learning and later be able to produce valuable and realistic student work products (Yanti et al., 2012). Thus, the use of PjBL can develop ideas, which means it can provide sensitivity to problem finding (Baird, 2019; Ferrero et al., 2021; Habók & Nagy, 2016).

PjBL characteristics include: (1) Students make decisions about a framework, (2) There are problems or challenges posed to students, (3) Students design a process to determine solutions to problems or challenges posed. (4) Students are collaboratively responsible for accessing and managing related information and solving problems by connecting to the real world, as well as authentic issues. (5) The evaluation process is carried out continuously, (6) Students periodically reflect on the activities that have been carried out, (7) The final product of learning activities will be evaluated qualitatively, (9) Learning is carried out as tolerant as possible to mistakes (Rati et al., 2017).

In full it can be revealed that the benefits of the PjBL model include the following: (1) Obtaining new knowledge and skills in learning, (2) Improving students' ability to solve problems, (3) Making students more active in solving complex problems by produce tangible products in the form of goods or services, (4) Develop and improve students' skills in

managing resources/tools/materials related to task completion, (5) Increase collaboration between group students. Meanwhile, the steps of the project-based learning model are: (1) Learning begins with essential questions, (2) Compile a design project, (3) create a schedule, (4) Monitoring students and project progress, (5) assess the outcome, and (6) evaluate the experience (Maryati, 2018).

The main requirements for using the PjBL model to develop the learning process in class are: 1) Mastery and deepening of the material, and 2) Mastery of scientific skills (Tinenti, 2018). Artinya, penggunaan model PjBL peserta didik terlebih dulu harus mmenguasai dan mendalami materi dan menguasai keterampilan ilmiah. Dengan syarat itu maka diketahui penggunaan model ini peserta didik diajak dulu menguasai materi dan keterampilan ilmiah. Apabila dalam proses student learning is involved in carrying out scientific investigation projects, the process will become more meaningful because students are given complete freedom in planning, designing, and carrying out a scientific investigation where these activities are still within the reach of their minds (Anthony Firdaus et al., 2020; Sutriyani, 2019; Utami, 2018).

CONCLUSION

Based on the results of the study it can be concluded that the development of a project-based learning model has an effect on the ability to find research problems of students in the Learning Strategy course. Based on the results of the analysis, it shows that tcount > ttable (31.78 > 2.02619), which means that there is a significant difference, so that the development of the PjBL model has an effect on the ability to find research problems in the Learning Strategy course.

RECOMMENDATION

We recommend that for further research are to be able to use a project-based learning model in measuring students' ability to compile research proposals/ability to write scientific papers related to Learning Strategies.

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