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The effect of project-based learning model on PGSD students' critical thinking skill

Nada Savitri Nawangsari [1] *, Pratiwi Pujiastuti [1], Dhiniaty Gularso [2]

[1] Universitas Negeri Yogyakarta. Jl. Colombo No. 1, Karangmalang, Yogyakarta 55281, Indonesia
[2] Universitas PGRI Yogyakarta. Jl. IKIP PGRI I Sonosewu No.117, Yogyakarta 55182, Indonesia
* Corresponding Author. E-mail: nadanawangsari@gmail.com

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Abstract: This study aims to determine the effect of the project-based learning learning model on the thinking skills of PGSD students in the Social Sciences 1 course. The method used in this research is an experiment. The subjects in this study were PGSD students. There are two classes in this research design, namely the experimental class and the control class. The experimental class consisted of 37 students and the control class also consisted of 37 students. Data collection techniques used observation and document analysis. The data analysis technique used in this research is descriptive analysis calculated by comparing the average value of each variable with the standard curve criteria. The analysis prerequisite test uses the normality test. The hypothesis test used is the t-test. The results showed that the project-based learning model has a significant effect in improving students' critical thinking skills.
Keywords: project-based learning, critical thinking, Social Science

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Introduction

Although cognitive is still considered the main predictor of educational performance (Lovden et al., 2020), psychomotor and affective are also prioritized in education nowadays because all three will be very useful in everyday life. Furthermore, education must consistently be implemented as a conscious effort in developing humans to mature intellectually, socially, and morally. The implementation of education from time to time will undoubtedly be faced with a challenge, but the main thing is to create an educational process that has aspects of developing a skill for students that will be used for their present and future life (Chusni et al., 2020). Furthermore, adjusting to the applicable curriculum in higher education, students are expected to be agents of change that brings goodness to the future. Therefore, the concept of education in the 21st century is shaping students into figures who have various skills, including problem-solving, critical thinking, collaboration, and communication. Moreover, the skills that are needed and developed are technical, information management, communication, collaboration, creativity, critical thinking, and problem-solving, while other skills that are also needed are ethical awareness, cultural awareness, flexibility, self-direction, and growth mindset (Laar et al., 2017). These skills are essential because they will be helpful to students.

Social Studies is one of the learning contents that can equip students to have these skills because the scope of social studies is everything related to humans and their environment. The scope of discussion in social studies is comprehensive, sometimes becomes a burden for students to learn since it is identical to rote learning. However, Social Studies is not studied with rote techniques but rather on critical thinking skills because many topics in social studies lessons are related to various problems in the surrounding environment that require solutions (Nurhayati et al., 2020). The Social Studies learning process should be done student-centered, and the class atmosphere will be more interesting if students are allowed to convey their ideas. Teachers and lecturers are also expected to recognize the characteristics of their students so they can explore the potential that exists in students. Creating a pleasant Social Studies learning atmosphere is also very necessary, hence teachers are required to be more active and creative in the learning process.

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Based on the results of initial observations on the PGSD study program at University of P for the Social Sciences 1 course, it was found that most students still looked less enthusiastic in attending lectures in one class. Students seem awkward, tense, and less active in this course. This can be seen from the implementation of lectures through Google Meet where most students chose to turn off the camera, continued the Google Classroom platform, some students were late in submitting assignments, and only a few students were active in the WhatsApp group. When viewed from the results of student work on the first assignment given by the lecturer, there are similarities in the answers between students and other students. The sentence descriptions are almost similar, showing that students' critical thinking skills through written answers still lack depth.

Critical thinking is one of the abilities that must be developed as the primary goal of education in society (Larsson, 2017). Being a student means being at a higher level than the previous levels. Being a student also means being ready to solve various problems that exist in the surrounding environment by using the knowledge that has been learned. One of the provisions is to have the skill to think critically, thus the students can contribute innovative thinking and solve a problem or give a solution. However, one of the challenges in learning at the tertiary level is how to bring an understanding of the education system into it (Bunn et al., 2019). Therefore, developing critical thinking skills can be done through learning practices in lectures using various methods, strategies, and learning models determined by the lecturer, and one of which is by using the project-based learning model. The use of project-based learning model based on personal or real experience can help students reflect on their critical thinking by analyzing in-depth the problems that exist and can be found in everyday life; thus, the provision of good critical thinking skills will be beneficial (Aranguiz et al., 2020). Therefore, the researcher wants to conduct a study on applying the project-based learning model in the Social Sciences 1 course, PGSD FKIP study program, University of P. It is assumed that is a learning model using activities or projects to provide an understanding of one material. Through this model, students are expected to develop their knowledge more critically.

The concept of critical thinking applies to all types of knowledge and involves students in the knowledge construction process through reflection and deep-thinking activities. The characteristics of someone who has the skill to think critically is to have curiosity and various questions at the same time will try to find answers to the questions they ask (Saleh, 2019). Critical thinking is a mental activity conducted using the steps in the scientific method, such as understanding and formulating problems, collecting and analyzing necessary and reliable information, formulating presumptions and hypotheses, logically testing hypotheses, drawing conclusions carefully, conducting evaluation, deciding what to believe, and predicting the consequences that might occur. Critical thinking is also a skill used not to think about oneself but to shape a person to be more alert and have the nature to be curious, inquire, assess, and evaluate all sources critically (Wale & Bishaw, 2020). Critical thinking has a goal to make someone choose and weigh what decisions or actions they want to choose as their decision (Saputri et al., 2020). Based on some of the arguments above, it can be concluded that critical thinking is a skill to produce logical decisions to be believed or rejected by thinking about possible consequences.

An indicator is a condition measurement that can measure changes that occur in an event or an activity. For example, a critical thinking indicator can be a measurement used to measure a person's critical thinking skill. The following are some indicators of critical thinking, i.e., 1) able to formulate the main points of the problem, 2) able to disclose the facts needed in solving problems, 3) able to express the facts needed in solving a problem, 4) able to choose logical, relevant, and accurate arguments, 5) able to determine the consequences of a statement taken as a decision (Ennis, 2011). Other opinions about critical thinking indicators are 1) performing primary classification by focusing questions, analyzing arguments, and asking questions that require explanations, 2) providing a basis for a decision, 3) concluding by making deductions and assessing the results of deductions, 4) conducting further clarification by defining and assessing definitions and identifying assumptions, 5) conducting conjectures and integration including guessing and combining (Firdaus et al., 2019). Based on the two expert arguments, it can be concluded that the indicators of someone having critical thinking skills are 1) conducting an in-depth study of the problem, 2) revealing possible solutions, 3) determining the solution to the problem, 4) delivering arguments logically and critically, and 5) determine the consequences of the decisions taken.

The project-based learning model is becoming an increasingly popular learning model not only in the United States but throughout the world. Buck Institute for Education believes that this learning

model will become a permanent feature of education in the 21st century (John, 2018). Project-based learning is a learning model that uses problems as the first step in collecting and integrating new knowledge based on experience and actual activities (Daryanto & Rahardjo, 2012:162). It is also a learning model that directly involves students through research activities to complete a specific learning project by developing solving skills in working on a project to produce something (Sari & Angreni, 2018). Project-based learning aims to focus students on a complex problem, where it is necessary to investigate, hence students will understand the lesson through investigation (Mulyasa, 2013). The findings from research conducted in Turkey generally show that using the project-based learning model, mainly applied to Social Studies learning, can positively impact students' conceptual understanding abilities. Therefore, the conclusion from the study is that the project-based learning model is appropriate for Social Studies learning (Ilhan, 2014). The project-based learning model means learning by using projects as the method, and students will work in real terms to produce products realistically. The characteristics of the project-based learning model are the educator poses a problem that must be solved by the student, the student designs the process and framework to create a solution, followed by the collaboration of the student to evaluate the performance results, thus a product will be established based on the background of the problem.

Method

Types of research

This type of research uses a quantitative research approach with a Quasi-Experimental type of experimental research design. This research was conducted at the University of P in the Department of Elementary School Teacher Education, Faculty of Teacher Training and Education in class A6 and A8 semester II. This research was conducted from March to May 2021. The University of P is located at Bantul Regency, Province of the Special Region of Yogyakarta.

Research settings

The experimental class consisted of 37 students and the control class also consisted of 37 students. The experimental class uses the project-based learning model, while the control class uses the problem-based learning model. Both classes will produce a product in a poster, and the poster score will be analyzed using a t-test with the SPSS 20 program.

Lecture activities in the experimental class and control class follow the syntax according to their respective learning models. The experimental class that uses the project-based learning model follows the syntax or learning steps, namely 1) pre-project conducted by practitioners or lecturers to design project descriptions, determine project milestones, prepare media and various learning resources, and prepare learning conditions, 2) phase 1-identifying products, such as observing particular objects, identifying problems and formulating problems in the form of questions, 3) phase 3-conducting research, such as collecting data and analyzing, 4) phase 4-preparing product drafts or prototypes as initial product designs based on the results of their research, 5) phase 5-measures, assesses, and improves the product, such as reflecting the initial product that was made to find its shortcomings and improving it again, 6) phase 6-finalization and product publication, such as students finalizing the product after it is believed to be published, and 7) post-project, where the practitioner or lecturer assessing, providing reinforcement, input, and suggestions for products that have been produced by students (Abidin, 2016).

The control class uses the problem-based learning model following the syntax or steps, namely 1) student orientation to the problem, in this case, the practitioner or lecturer also provides direction on the focus of the problem to be studied, 2) organizes students to learn, meaning that students will be directed to study more deeply about the problems that have been found, 3) guiding individual and group investigations at this stage, the practitioner or lecturer monitors the problem assessment process conducted by students, 4) develops and presents the work, and 5) analyzes and evaluates the problem-solving process.

Data collection technique

Data collection techniques used observation and document analysis. Observation guidelines function to see the student learning process virtually. In addition, observation is also used to monitor the product. Meanwhile, document analysis analyzes the results of student work from the pretest, the resulting product, and the posttest.

Data analysis technique

The data analysis technique used in this research is descriptive analysis calculated by comparing the average value of each variable with the standard curve criteria. The analysis prerequisite test uses the normality test of the data while the hypothesis testing is conducted after the analysis requirements test is met because there are only two groups. The hypothesis test used is the t-test.

Results and Discussion

Result

The results of this study show some data including the average score of pretest and posttest on critical thinking skills in the experimental class and control, data from the normality test results for the experimental class and control class, as well as data from the T test analysis. Normality test and T test were carried out with the SPSS 20 program.

Tabel 1. Students' critical thinking score

Class	Pretest	Posttest
Experiment	45,08	49,73
Control	45,24	49,16

Referring to the results of students' critical thinking scores in the experimental class, there was an increase of 4.65 points, with an average pretest score from 45.08 to 49.73 in the posttest. Meanwhile, the control class experienced an increase of 3.92 points, with an average pretest score from 45.24 to 49.16 in the posttest score.

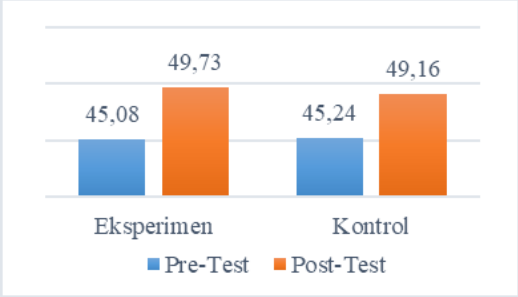

Figure 1. Bar chart of students' critical thinking score

Furthermore, the results also showed the data from the normality test in the experimental class and the control class, and the t-test results to draw conclusions from the research hypothesis. The results of the study are said to be normal if the Asymp value. Sig obtained > 0.05, whereas if the results obtained ≤ 0.05 then it is not normally distributed (Saputri & Herwin, 2020; Pangestu et al., 2020; Wuryandani & Herwin, 2021; Kumalasari et al., 2020). The following is a summary of the data normality test results.

Table 2. Experimental class normality test

	Statistic	df	Sig.
Pretest	.133	37	.096
Postest	.141	37	.060

Moreover, as seen from the results of the normality test, the experimental class data has a sig value of 0.096 at the pretest and 0.060 at the posttest, and both sig values in the experimental class are more than 0.05, meaning that the data is normally distributed.

Table 3. Control class normality test

	Statistic	df	Sig.
Pretest	.136	37	.080
Postest	.140	37	.063

The results of the normality test of the control class data, namely the sig value in the pretest of 0.080 and 0.063 in the posttest, both were also more than 0.05, so that the data in the control class was normally distributed. After the normality test was carried out, the homogeneity test was then carried out with the following results.

Table 4. Homogeneity test

Levene Statistic	df_1	df_2	Sig.
.014	1	72	.907

The sig value obtained from the homogeneity test is 0.907. As the value is more than 0.05 both data are said to be homogeneous, which then proceed with hypothesis testing using t-test with the following results.

Table 5. Inferential test results (t-test)

		Std. Dev	Std. Eror	Sig.
Control Class	Pre-Post	2.163	.356	.007
Experimental Class	Pre-Post	.722	.112	.014

The results of the value of Sig. (2-tailed) in the experimental class is 0.007 and the control class is 0.014, so the value is smaller than 0.05. Therefore, H_0 is rejected and H_1 fails to be rejected, and the gap in students' critical thinking results is also affected by the difference of the learning model used. So, the project-based learning model gives a greater influence on students' critical thinking skills.

Discussion

Based on the aforementioned data, it is safe to say that there is a significant influence on the use of the project-based learning model on the critical thinking skills of PGSD students in the Social Sciences Course 1. Project-based learning possesses a syntax in the form of activities that involve the thinking process, so students will get used to think critically. Students who are able to think critically will be prepared when they encounter a problem or want to develop something, because they will think logically, in detail, and reflectively. A cooperative learning environment can further improve critical thinking skills since discussion is the core in the learning process, making a more authentic environment. Students will have high-level critical thinking skills and independent thinking. This can provide opportunities for them to explore new ideas and skills in scientifically solving a problem (Gonzalez & Mariscal, 2021).

At the initial meetings prior to the implementation of the project-based learning model, observation was done to discover the students' understanding of social studies subjects, by asking basic questions about social sciences such as geography, history, economics, anthropology, sociology, law, psychology, and philosophy, which proceed with associating the results with the authors or the students' personal experiences. Considering the students' work results, it was found that almost all of the answers regarding the aspects of anthropology (human and cultural) did not provide in-depth elaboration. Additionally, even though the questions given were based on the area of origin, students did not provide a more comprehensive answer. The project-based learning model was then applied to the experimental class, so the lecture process was adjusted to the project-based learning syntax or steps. Then, practitioners (lecturers) determined the topics that were developed using the project-based learning model and asked students to analyze some potential within their area of origin, look for related facts, then conduct promotions, which are integrated in the form of poster. In this case, practitioners (lecturers) provide grid points that were used as a reference for product development.

The next step is students were required to do some preparations for creating products, which is by filling in the grid that has been given by the practitioner (lecturer) so that they will have an idea of what will be included in the poster. Then, the students make the product design manually, creating a draft or outline so that the appearance of the product is visible. By the time they have finished the poster, they launch it. This product displays various information according to the grid at the earlier stage, making the product ready to be published on their social media such as Instagram, Facebook, and WhatsApp. The finished product is then assessed by the practitioner (lecturer) to see the extent to which

the depth of student development in reviewing the topic has been determined using the project-based learning model.

The steps are in accordance with what was conveyed by (Abidin, 2016) in the pre-project and post-project sections, where the practitioner (lecturer) provides a project description, determines the project milestones, prepares media and various learning resources, as well as prepares conditions for the project learning. At the final stage, the practitioner also provides an assessment and reinforcement of the product or project that has been produced by students. Besides that, the steps are also in line with Farindhani & Wangid (2019) who stated that the project-based learning method includes several activities, namely project preparation, project design, project launch, and project publication.

The students way of thinking seems to be in accordance with the critical thinking indicators where students can examine the topic in detail, which is reflected by the final product. The depth of thinking shows the importance of critical thinking skills for students. It is a must for universities to foster them, because they can improve their personal, interpersonal, and social competence (Indrasiene et al., 2019). Judging from the completeness of the information written, the writing is based on facts and interviews with figures so that it is relevant and accurate, promotive sentences are a form of logical argument as well as a statement. It is in line with experts opinion, which are 1) able to formulate the main points of the problem, in this case students are able to study, 2) able to reveal facts needed in solving problems, 3) able to reveal facts needed in solving a problem, 4) able to choose logical, relevant, and accurate arguments, 5) able to determine the consequences of a statement taken as a decision (Ennis, 2011). As a student, critical thinking is essential for the development of the student's mindset as a form of readiness to become a professional in their fields. Therefore, the development of students' critical thinking skills becomes a mission in the higher education (university) (Prayogi et al., 2018).

The influence of the project-based learning model on someone's critical thinking skill is proven by research that has been conducted in Japan, at a school where students are given a problem then asked to design a solution. The results of the study indicate that students have critical thinking to criticize their own plans and rebuild more realistic criticisms to solve problems contextually after using the project-based learning model (Mutakinati et al., 2018). The application of project-based learning can achieve the learning objectives, as seen from the pretest and posttest. Moreover, during the project, there are differences in the depth of analysis done by students on the predetermined topic. Those are in line with a study which stated that 1) students become more challenged in solving real problems, 2) students are more active in learning, 3) student performance improve during project implementation, 4) students have flexibility in project completion, and 5) students are enthusiastic in competing to produce the best projects (Oktavianto et al., 2017). Project-based learning itself is included in cooperative learning, which means that it can foster an attitude of interdependence in a positive way, learning becomes more enjoyable due to collaboration between teachers and students, as well as many opportunities to express emotional experiences in a fun way (Purwanto et al., 2020). These aspects prove that the project-based learning model has a significant influence in improving one's critical thinking skill. The use of project-based learning models can make students feel more concrete learning. This statement is in line with the results of research that has been done, as students are able to understand more deeply about what is happening around them and provide real solutions (Sari & Angreni, 2018).

Generally, the project-based learning model is the appropriate model to develop one's thinking skills because each of the step always involves activities from the learner, both physical activity, and thinking. In line with a research conducted in Malaysia regarding the effect of adventure-based learning strategies on critical thinking skills, the results show that adventure-based learning involving physical activity is effective in influencing students' critical thinking skills (Setambah et al., 2019). Juano & Pardjono (2016) said that the implementation of the project-based learning method is suitable to develop students' critical thinking skills. This opinion is also supported by Moore (Moore, 2014) who argued that critical thinking skills are related to cognitive processes, which cover the skill to implement solutions to problems, make decisions, ask questions, design plans, define assessments, organize information, and create new ideas. This process is in accordance with the steps in the project-based learning model which strengthens the results of this study because the model has an effect on critical thinking skill.

Conclusion

Based on the results and discussions described, it can be concluded that the project-based learning model has a significant effect in improving students' critical thinking skills. This is because the syntax in this learning model contains various activities that encourage students to think and play an active role. In Social Studies lectures, contextual learning is needed to understand better the material being discussed. Social Studies is also an ideal field of study to develop critical thinking skills because its scope is very close, the surrounding environment. The project-based learning model in Social Studies lectures can achieve learning objectives. Following these conclusions, there are several suggestions addressed by researchers to readers, lecturers, teachers, and parents that the project-based learning) model can be used to improve students' critical thinking skills. Educators also need to master the model so it can be appropriately applied, and this model can also be used to achieve learning objectives.

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