



Effectiveness of Project-Based Learning in Improving Critical Thinking Skills and Environmental Concern Attitude in Vocational Students

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Abstract

Creating conducive learning must be supported by skills in managing classes, learning media and learning models. One learning model so that students have these skills is the project-based learning model. The aim of this research is to determine the effectiveness of implementing the project-based learning model on critical thinking skills and attitudes towards the environment. This research was conducted at vocational students in Banjarmasin City. This research uses a quantitative approach with experimental methods. The results of this research indicate that project-based learning is effective in increasing critical thinking skills and environmental concern for wetlands. This is proven by testing the effectiveness of critical thinking skills with the Asymp value. Sig. (2-tailed) is $0.003 < 0.05$ and tests the effectiveness of the attitude of caring for the wetland environment with the Asymp value. Sig. (2-tailed) is $0.000 < 0.05$.

Keywords: Problem based learning, Critical thinking skill, Environmental Attitude

Introduction

The development of the 21st century world is characterized by the use of information and communication technology in all aspects of life, including in the field of education. The ability to think critically, solve problems and collaborate are important competencies in entering the educational life of the 21st century. Schools are also required to be able to produce students who must have 4 skills or characteristics of the 21st century, abbreviated as 4C, namely Communication (communication), Collaboration (collaboration), Critical thinking and problem solving (critical thinking and solving problems), and Creativity and innovation (creative and innovative). Learning in the context of 21st century learning, especially in the 2013 curriculum, means that students learn material through examples, applications and real

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world experiences both inside and outside school (Rahayu et al., 2022). Cevik & Senturk proposed five main groups of skills: Information and Technology Literacy Skills, Critical Thinking and Problem Solving Skills, Entrepreneurship and Innovation Skills, Social Responsibility and Leadership Skills and Career Awareness (Cevik & Senturk, 2019).

Carrying out teaching and learning activities in schools is certainly not merely a transformation of knowledge, but an educational effort that seeks to produce complete humans, not only cognitively but also in affective and psychomotor terms, especially for Citizenship Education subjects. Citizenship education aims to provide knowledge and understanding, especially knowledge and understanding of the national system and political history, as well as developing understanding, skills, motivation and action by directly experiencing citizenship issues (Carretero et al., 2015).

Citizenship education has become an inherent part of the instrumentation and praxis of national education to educate the lives of the Indonesian people through the corridor of "value-based education". The configuration or systematic framework of Citizenship Education is built on the basis of the following paradigm: First, Civics is curricularly designed as a learning subject which aims to develop individual potential to become Indonesian citizens with noble, intelligent, participatory and responsible character. Second, Civics is theoretically designed as a learning subject that contains cognitive, affective and psychomotor dimensions that are confluent or mutually interpenetrating and integrated in the context of the substance of ideas, values, concepts and morals of Pancasila, democratic citizenship and national defense. Third, Civics is programmatically designed as a learning subject that emphasizes content that carries values (content-embedding values) and learning experiences in the form of various behaviors that need to be realized in everyday life and is a life guide for citizens in life. society, nation and state as a further elaboration of the ideas, values, concepts and morals of Pancasila, democratic citizenship and defending the country (Tyas & Mawardi, 2016).

However, the facts in the field of implementing Citizenship Education learning are often different from what is expected, shifting slightly from the government's expectations (Widiana et al., 2022). The reality in the field shows that PPKn is synonymous with learning that contains boring material (Hatami, 2020). The cause of low student activity and learning outcomes in Civics learning is that the learning delivery that has been developed has not been able to make students motivated and challenged to learn optimally. The cause of this situation is that the learning model applied is monotonous and teacher-centered so that it tends to make students bored (Sanjaya et al. ., 2022). The teacher-centered learning model must be immediately abandoned and replaced with an active and independent learning model based on modern cognitive principles, so as to foster the active and creative role of students (student centered). Teachers are no longer the main learning source who have dominant power over students (Jagantara et al., 2014).

Students' creative thinking abilities are low if they use conventional learning media (Syahputri & Murdiono, 2022). A teacher's success in creating a conducive classroom atmosphere must be supported by his skills in managing the classroom, learning media, and learning models (Firman, 2022). Teachers can try various strategies, methods or learning models (Hasibuan & Rahmawati, 2019). One learning model so that students have these skills is the project-based learning model. The project-based learning model is an innovative learning model that focuses on contextual learning through complex activities (Indrawijaya & Siregar,

2022). Project-based learning (PjBL) has a lot of potential to improve 21st century skills and engage students in real-world tasks (Aksela & Haatainen, 2019).

Several research findings conclude that project-based learning has proven effective in developing critical thinking skills, student activity and student creativity (Guo et al., 2020). PBL is an effective method for developing 21st century skills (Safaruddin et al., 2020).

Literature Review

Project-based learning is a learning model that requires teachers and/or students to develop a guiding question. Considering that each student has a different learning style, project-based learning provides students with the opportunity to explore content (material) using various methods that are meaningful to them, and carry out experiments collaboratively (Widiyatmoko & Pamelasari, 2012).

Project-based learning is a learning process to build students' complete understanding related to everyday life, discussing problems encountered independently and in groups, and students can show work (Nisa, 2021). With Project Based Learning, students are given the opportunity to manage learning in class by involving project work. Project work contains complex tasks based on questions and problems that challenge and guide students to solve problems, investigate, make decisions, and give students the opportunity to work independently (Lestari, 2015). Project-based learning focuses on students' ability to explore their knowledge through experience and curiosity in order to find solutions to the problems they face, as stated by John Dewey that learning can refer to the concept of learning by doing, which means that learning is said to have meaning if it is accompanied by actions according to desires that will be achieved (Widiastuti, 2015).

The advantages of project-based learning are (1) increasing students' motivation to learn; encourage their ability to do important work, and they need to be respected; (2) improve problem solving abilities; (3) make students more active and successful in solving complex problems; (4) increasing collaboration; (5) encourage students to develop and practice communication skills; and (6) improving students' skills in managing resources (Aditiyawarman, 2022).

Critical thinking skills are very important for everyone to have, because critical thinking is something that is very essential, and functions effectively in all aspects of student life (Wulandari, 2019). Critical thinking skills are a person's skills to analyze, solve problems, and evaluate one's own opinions which require discipline and deep and logical thinking (Saputro et al., 2019).

Critical thinking can also accustom students to think more rationally in determining and selecting the best alternative options (Firdaus et al., 2019). This description provides a clear picture of the importance of critical thinking skills for students (Ulfha et al., 2023). Project-based learning focuses students on real life to enrich their learning experience. Students will make observations to produce products or real work that will later be communicated and received responses. In project-based learning, students are encouraged to develop creativity, independence, responsibility, self-confidence and critical thinking (Mascita et al., 2020). Hake (Sarmilah and Tiwow, 2021) stated that the category of students' critical thinking skills is declared good if the level of students' critical thinking skills is at least medium to high.

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An attitude of caring for the environment in daily life in society is defined as a person's reaction to their environment, without damaging the natural environment. An environmentally caring attitude is interpreted as an individual's ability to understand the relationship between human activities and the quality of the environment that currently exists (Liu, Vedlitz & Shi, 2014; Mei, Wai, & Ahamad, 2016) and his desire to be involved in activities related to environment (Umuhire & Fang, 2016). An attitude of caring for the environment is an attitude that must be implemented at every level of education. All academics must have a caring attitude towards the environment. Education that cares about the environment is important for the younger generation to have so that in the future they can wisely manage the natural resources around them, as well as to foster a sense of responsibility for the interests of future generations to come. When the character of caring for the environment has grown into a strong mentality, it will underlie a person's behavior in everyday life. By caring for the environment, a clean and beautiful environment will be created (Tamara, 2016).

Research Method

This type of research is quasi-experimental with a posttest only control group design. Quasi Experiment (Quasi Experiment) is an experimental design that has a control group, but does not function fully to control external variables that influence the experiment (Sugiyono, 2015). This design was also chosen because the research to be conducted was not to determine the increase in understanding of concepts and critical thinking skills, so pre-test scores were not used. The experimental design is presented in table 1 below

Table 1. Experimental design

Group	Treatment	<i>Post-test</i>
Experiment	X ₁	O ₁
Control	X ₂	O ₂

Information:

X1: treatment of project-based learning models

X2: treatment of conventional learning models

O1: states the final observation (post-test) of the experimental group

O2: states the final observation (post-test) of the control group

(Tuckman, 1999)

The population in this study were all class X State Vocational School students who were in relatively similar regional characteristics, namely in Banjarmasin. Because it is in the same region and under the same government (Banjarmasin), the existing policies are certainly not much different between one SMK N and another SMK N. The sample in this study was selected proportionally, namely determining equal classes for each school. Two equivalent classes were selected for each school, both for the experimental class and for the control class.

The instruments used in this research were tests and non-tests. Before the instrument is used, both test and non-test instruments must first be tested for validity and reliability by testing the instrument first.

To test the validity of the construct, we will use opinions from experts (judgment experts). In this case, after the instrument has been constructed regarding the aspects to be measured based on certain theories, it is then consulted with experts (Sugiyono, 2015). Analysis of the validity of research instruments is very important, because validity means the accuracy and accuracy of a measuring instrument in carrying out its measuring function (Azwar, 2015).

After the data is obtained, the analysis prerequisite tests are first carried out, namely the normality test and homogeneity test. The data normality test was carried out to determine whether the data obtained from the population had a normal distribution or not using the SPSS for Windows 13.00 computer program. And the homogeneity test is carried out to test variations in a homogeneous population. The normality test is carried out to find out whether the data obtained is homogeneous or not for the two treatment groups. The homogeneity test is calculated using the F levene statistical test. After calculating normality and homogeneity, data analysis is carried out to test the hypothesis that has been proposed. This test was carried out to determine whether there were significant differences between students who were given treatment (PjBL model) and conventional learning. This hypothesis test was carried out using the "t test" formula.

Results and Discussion

This research was carried out on six groups of students in three schools, namely SMK Negeri 1 Banjarmasin, SMK Negeri 2 Banjarmasin and SMK Negeri 4 Banjarmasin. These three schools are schools that have implemented the Independent Curriculum. Each school is assigned a sample of two groups of students (2 classes), namely one experimental class and one control class.

Differences in Critical Thinking Abilities of Students Who Participate in Project-Based Learning and Expository Learning

Hypothesis testing uses the Mann-Whitney test, the hypothesis proposed is as follows.
Ha : There are differences in the critical thinking abilities of students who take part in project-based learning and expository learning.
Ho : There is no difference in the critical thinking abilities of students who take part in project-based learning and expository learning.

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Table 2. Statistic Test Result of Project-Based Learning and Expository Learning

Independent Samples Test					
		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Con. Interval of the Difference
					Lower
n_Gain	Equal variances assumed	.016	.19025	.07837	.03559
	Equal variances not assumed	.016	.19025	.07850	.03531

The results of the Mann-Whitney test analysis of the pre-test and post-test scores of students' critical thinking abilities can be briefly seen in the following table: Based on the table above, the results of the Mann-Whitney test on the test gain score produce a sig value. (2-tailed) 0.016 where the value is <0.05 . This shows that there are differences in the critical thinking abilities of students who take part in project-based learning and expository learning, so that H_a is accepted and H_o is rejected.

Differences in Environmental Concern Attitudes between Students Who Participate in Project-Based Learning and Expository Learning

Hypothesis testing uses the Mann-Whitney test, the hypothesis proposed is as follows.

H_a : There is a significant difference in environmental awareness attitudes between students who take part in project-based learning and expository learning.

H_o : There is no significant difference in environmental awareness attitudes between students who take part in project-based learning and expository learning.

The results of the Mann-Whitney test analysis of the initial questionnaire scores and the final environmental awareness questionnaire scores can be briefly seen in the following table:

Table 3. Statistic Test Result of Environmental Concern Attitudes between Students Who Participate in Project-Based Learning and Expository Learning

Independent Samples Test					
		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Con. Interval of the Difference
					Lower
n_Gain	Equal variances assumed	.000	.35740	.08040	.19865
	Equal variances not assumed	.000	.35740	.08135	.19654

Based on the table above, the results of the Mann-Whitney test on the questionnaire gain score produce a sig value. (2-tailed) 0.000 where the value is <0.05 . This shows that there is a significant difference in environmental awareness attitudes between students who take part in project-based learning and expository learning, so that H_a is accepted and H_o is rejected.

5.1.3. The Effectiveness of Project Based Learning (PjBL) on Students' Critical Thinking Skills

Hypothesis testing uses the Mann-Whitney test, the hypothesis proposed is as follows.

Ha = There is effectiveness of Project Based Learning (PjBL) on the critical thinking skills of students who take part in project-based learning and expository learning.

Ho = There is no effectiveness of Project Based Learning (PjBL) on the critical thinking skills of students who take part in project-based learning and expository learning.

The results of the Mann-Whitney test analysis of the pre-test and post-test scores of students' critical thinking abilities can be briefly seen in the following table:

Table 4. Mann-Whitney test analysis of the pre-test and post-test scores of students' critical thinking abilities

Test Statistics ^a	
	Result
Mann-Whitney U	3168.500
Wilcoxon W	7539.500
Z	-3.002
Asymp. Sig. (2-tailed)	.003

From the test results above, it can be seen that the value of Asymp. Sig. (2-tailed) is $0.003 < 0.05$. This shows that there is effectiveness of Project Based Learning (PjBL) on the critical thinking skills of students who take part in project-based learning and expository learning, so that Ha is accepted and Ho is rejected.

The Effectiveness of Project Based Learning (PjBL) on Environmental Concern Attitudes

Hypothesis testing uses the Mann-Whitney test, the hypothesis proposed is as follows.

Ha = There is the effectiveness of Project Based Learning (PjBL) on the environmental awareness attitudes of students who take part in project-based learning and expository learning.

Ho = There is no effectiveness of Project Based Learning (PjBL) on the environmental awareness attitudes of students who take part in project-based learning and expository learning.

The results of the Mann-Whitney test analysis of the initial and final questionnaires regarding students' environmental awareness can be briefly seen in the following table:

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Table 5. Mann-Whitney test analysis of the initial and final questionnaires regarding students' environmental awareness

Test Statistics ^a	Critical Thinking Skill
Mann-Whitney U	2078.500
Wilcoxon W	5399.500
Z	-4.505
Asymp. Sig. (2-tailed)	.000

From the test results above, it can be seen that the value of Asymp. Sig. (2-tailed) is $0.000 < 0.05$. This shows that there is effectiveness of Project Based Learning (PjBL) on the environmental awareness attitudes of students who take part in project-based learning and expository learning, so that H_a is accepted and H_o is rejected.

Based on the hypothesis test for assessing students' critical thinking abilities, the test results in the experimental class and control class were different. The difference test was carried out using the Mann-Whitney test on the n-gain score test. The calculation shows the sig value. (2-tailed) $0.016 < 0.05$, which means that there is a significant difference in students' critical thinking abilities between classes that use project-based learning and classes that use expository learning. So it can be concluded that H_o is rejected and H_a is accepted.

Overall, the average critical thinking ability for the experimental class reached 79.011%, higher than the test results for the control class, namely 68.387%. Based on this, it can be concluded that the project-based learning method is better in improving students' critical thinking skills in Civics learning activities at Banjarmasin State Vocational School. This is in line with research conducted by Nur Hikmah, Endang Budiasih, and Aman Santoso (Hikmah et al., 2016) which shows that project based learning (PjBL) affects the critical thinking abilities of class XI science students on colloidal materials. Improving students' critical thinking skills is more optimal in classes that use a project-based learning model, influenced by several factors, such as phases in learning and group division factors.

The phase factors in project-based learning have six phases or steps in its implementation including activities of determining basic questions, preparing project plans, preparing schedules, monitoring, assessing results and evaluating (Fitriyah & Ramadani, 2021). In line with Mihardi's opinion, when making a project, students must be involved in solving problems, making decisions, or investigative activities, so that students have the opportunity to be independent in producing a realistic product and presentation (Fitriyah & Ramadani, 2021).

The increase in students' critical thinking skills taught in project-based learning (PjBL) is due to the fact that in the project process, students are involved in constructive questions in the form of design processes, decision making, problem solving and problem solving. This is in line with Isnani's opinion, which explains that Project Based Learning is an innovative learning model or approach that emphasizes learning contextually through complex activities (Kristiyanto, 2020).

The next factor is group division. The existence of this group division is able to increase students' critical thinking because each group collects and accesses as much information as possible by students through internet and library sources. This is because the nature of the project-based learning model is flexible, that is, students are allowed to access and collect

information related to the material on the Application of Pancasila Values in Daily Life in preparing projects. This is also in line with the opinion of Thomas who stated that Project Based Learning (PjBL) can improve students' critical thinking skills because Project Based Learning (PjBL) is learning that focuses on the main concepts and principles of a discipline, involving students in problem solving and other meaningful tasks, giving students the opportunity to work autonomously to construct their own learning, and culminate in producing valuable and realistic student work products (Kristiyanto, 2020).

The project-based learning model is also effective in improving students' critical thinking skills. This is proven by the research results which show that the value of Asymp. Sig. (2-tailed) is $0.003 < 0.05$. So it can be concluded that there is effectiveness of the project-based learning model on students' critical thinking abilities. This is also in line with research from Fitriyah and Ramadani (2021) which states that PjBL-based STEAM learning has a significant effect on students' critical thinking skills.

Besides being effective in improving critical reasoning, the project-based learning model is also effective in increasing students' caring attitude towards the environment. This is based on the statistical results of environmental protection behavior using an independent T test with a significance level of 5% showing that the project-based learning method has a significant influence on students' attitudes towards protecting the environment and a score < 0.05 .

Based on the results of the Mann-Whitney test analysis of the questionnaire gain score, a sig value was obtained. (2-tailed) 0.000 where the value is < 0.05 so it can be concluded that there is sufficient evidence to reject H_0 . Thus, it can also be concluded that there is a significant difference between project-based learning and expository learning in increasing the attitude of caring for the wetland environment of class

The results of the student environmental awareness questionnaire show that the project-based learning model has a significant effect on environmental care attitudes in the material Application of Pancasila Values in Daily Life. In line with research conducted by (Rafsanzani et al., 2020) which shows that there is a significant influence from the use of the Project Based Learning model on the environmental care attitude of class VII students at SMP Negeri 2 Pesawaran on the subject matter of Environmental Pollution with the average learning outcomes students in the experimental class was 76.13 while the control class was 69.30.

This is because the project-based learning model makes students the center of learning so that the learning process becomes two-way between educators and students. Students are taught to study independently after receiving an explanation of the subject matter to be worked on. This material is about the Application of Pancasila Values in Daily Life, which also teaches about how important the environment is for life. In line with the opinion of (Perkasa et al., 2018), environmental care is a representation of students' knowledge, attitudes and skills through learning to be able to solve environmental problems around them.

The project is given in an environment where students are invited to create digital comics in groups. By linking the discussion, students are expected to be able to prevent and avoid the factors that cause environmental damage. This is related to the opinion of Tanjung (2021) which states that caring for the environment is attitudes and actions that always try to prevent damage to the surrounding natural environment, and develop efforts to repair natural damage that occurs. An environmentally caring attitude can also be interpreted as a conscious effort to prevent, improve and preserve the surrounding natural environment.

Conclusion

Based on the results of data analysis and discussion, it can be concluded that: First, there are differences in the critical thinking abilities of students who take part in project-based learning and expository learning. This is proven by the results of the Mann-Whitney test on the test gain score which produces a sig value. (2-tailed) 0.016 where the value is <0.05 . Second, there are differences in attitudes of concern for the wetland environment between students who take part in project-based learning and expository learning. This is proven by the results of the Mann-Whitney test on the gain score of the questionnaire which produces a sig value. (2-tailed) 0.000 where the value is <0.05 . Third, project-based learning is effective in increasing critical thinking skills and environmental awareness of wetlands. This is proven by testing the effectiveness of critical thinking skills with the Asymp value. Sig. (2-tailed) is $0.003 < 0.05$ and tests the effectiveness of the attitude of caring for the wetland environment with the Asymp value. Sig. (2-tailed) is $0.000 < 0.05$

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