PjBL Learning Model Assisted by YouTube: The Effect on Student's Critical Thinking Skills and Self-Confidence in Physics Learning

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Article Info	Abstract
	Low critical thinking skills and self-confidence can affect the learning process of students. In overcoming this problem, a suitable learning model and learning media are needed. This study aims to determine the effect of the YouTube-assisted PjBL learning model on students' critical thinking skills and self-confidence. This research is quasi-experimental with a non-equivalent control group design. The population in the study consisted of 185 eleventh-grade students of SMAN 16 Bandar Lampung. The research sample consisted of classes, class XI IPA 1 as the control class and XI IPA 2 as the experimental class, selected by cluster random sampling technique. Data collection instruments were an essay test of five questions and self-confidence questionnaires. Based on the analysis using the MANOVA test, the significant values for critical thinking skills of 0.008 and self-confidence of 0.000 were obtained. These values indicate that H_1 is accepted. Thus, it can be concluded that the YouTube-assisted PjBL learning model affects students' critical thinking skills and self-confidence in physics learning.

INTRODUCTION

The 21st century is marked by the rapid development of technology and information in all aspects of life. As a result, this century has experienced significant changes in various fields of life (Vinu et al., 2011). The learning system in the 21st century is no longer teacher-centered learning but student-centered learning (Perry, 2006; Wu, 2021). The 21st-century learning applies creativity (Khandelwal & Mehta, 2023), critical thinking (Kocak et al., 2021; Osman et al., 2020), cooperation, problem-solving (Szabo et al., 2020), communication skills (Demirdag, 2022), sociability, and character skills (Taylor, 2018). Being skilled in solving problems means being able to overcome the problems. In teaching-learning, students who can solve these problems think critically (Bana et al., 2022; Mardhiyah et al., 2021; Seibert, 2021; Zuryanty et al., 2019).

Critical thinking is a reflective process that focuses on deciding what to believe or do. Critical thinking becomes part of the reflective component of an active and persistent thinking process that uses prudence to weigh beliefs, build related knowledge, and draw conclusions. (Rudianto et al., 2022). Critical thinking involves thinking about content, problem, or subject to acquire knowledge and skills and find solutions to a problem so that it can reason information logically and give appropriate and accurate decisions. (Fazriyah, 2016). Mastering critical thinking skills in 21st-century learning is important (Basri et al., 2019; Rosidin et al., 2019; Voogt et al., 2018). Critical

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thinking skills will affect the level of self-confidence of students (Yıldız-Feyzioğlu & Kıran, 2022). However, students' thinking skills are still in the low category. This is proven by various previous studies (Borromeo, 2016; Rusmansyah et al., 2019; Sari et al., 2019; Susilo & Darhim, 2019). Therefore, it is important to improve students' critical thinking skills.

Developing students' critical thinking can be done through the use of appropriate models, namely the Stimulating Higher-Order Thinking Skills model (Saputri et al., 2019), Problem-based Learning (Qondias et al., 2022), Scientific Critical Thinking learning model (Rusmansyah et al., 2019) blended learning model (Samura, 2023) Project-based learning (Jirana et al., 2020). Grant stated that the right learning model used to develop critical thinking skills is the Project Based Learning learning model. This learning model has advantages; it Increases motivation and improves problem-solving, collaboration, and resource management skills (Grant, 2002). Project-based learning starts with a fundamental question and ends with a product. This model makes students more able to interpret their knowledge to increase their critical thinking skills. Objects used as project-based learning materials that are contextual and around students' environment will impact increasing students' critical thinking skills (Kurubacak, 2007). Besides, this model allows students to complete projects with confidence in the results.

The right learning model is very important, but learning media is also a component that is no less significant. Learning tools or media can facilitate educators and students in the learning process. One of them is YouTube (Surya et al., 2022). YouTube is a database of video content that is very popular on social media and provides a variety of information that is very helpful. YouTube has a function to find information about a video or watch videos directly (Faiqah et al., 2016). Previous research revealed that YouTube could improve student learning outcomes (Raharjo, 2022).

Research on implementing the project-based learning model has been widely carried out. Among them are to improve creative skills (Ningsih et al., 2020), communication skills (Ambarwati et al., 2015; Saimon et al., 2023), critical thinking skills (Adekantari et al., 2020; Sularmi et al., 2018), and higher-order thinking skill (Martawijaya et al., 2023). From the results of previous studies, no researcher has examined two dependent variables at once, critical thinking skills and self-confidence, in the independent variable of the PjBL learning model assisted by YouTube. Therefore, this study aims to determine the effect of the YouTube-assisted PjBL learning model on students' critical thinking skills and self-confidence.

METHODS

The method used in this study is quasi-experimental with non-equivalent control group design. In this design, there is an experimental group and a control group. Table 1 depicts the research design.

Table 1. Non-equivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experimental	O_1	X_1	O_2
Control	O_3	X_2	O_4

Both groups were given a pretest to determine the student's initial state in this design. A posttest was administered to determine the final state after being treated in an experimental class using the YouTube-assisted PjBL learning model, and the control group was given treatment using a STAD-type cooperative model (Sugiyono, 2017).

The independent variable in this study was the YouTube-assisted PjBL learning model (X). The dependent variables were critical thinking skills and self-confidence (Y1 and Y_2). The population of this study was 185 eleventh-grade students of the science major of SMA Negeri 16 Bandar Lampung in the 2022/2023 academic year. The researchers employed the cluster random sampling technique to obtain class XI IPA 1 as a control class (28 students) and class XI IPA 2 as an experimental class (28 students).

Data was collected through a critical thinking skills test consisting of five questions about static fluid in the form of essays. It included critical thinking indicators and self-confidence questionnaires consisting of 25 statements. In this study, self-confidence was measured using a

Likert scale consisting of four answer choices, namely strongly agree (SS), agree (S), disagree (TS), and strongly disagree (STS).in this case, the questionnaire assessment score in positive items were given a value of 4-1 and negative was given a value of 1-4. The following tables 2 and 3 are guide scores and interpretation criteria.

Table 2. Questionnaire Scoring Guidelines

Positive Statements		Negative Statements	
Score	Information	Score	Information
4	Strongly Agree	1	Strongly Agree
3	Agree	2	Agree
2	Disagree	3	Disagree
1	Strongly Disagree	4	Strongly Disagree

Table 3. Questionnaire Score Interpretation Criteria

Score Interval	Category
76-100	High
51-75	Medium
25-50	Low

The research instrument passed the validation stage by experts. The reliability test used the Cronbach Alpha formula (Triana & Oktavianto, 2013). The data analysis was assisted by SPSS version 25. First, the normality test was performed using the Kolmogrov-Smirnov test. Second, the homogeneity test was performed using the One-Way ANOVA test. MANOVA is a statistical technique used to calculate the significance test of the mean difference simultaneously between groups with two or more dependent variables (Saregar et al., 2016).

RESULTS AND DISCUSSION

This study aims to determine the influence of the PjBL learning model assisted by YouTube on students' critical thinking skills and self-confidence in physics learning. The following explains the learning process using the YouTube-assisted PjBL learning model. The first meeting began by giving students a pretest in the form of essay questions, followed by conveying goals and providing motivation. Stimulation is also given by studying Static Fluid material and providing questions related to the application (hydrostatic pressure, Pascal's law, and Archimedes' law) in everyday life (Dinda & Sukma, 2021).

In the second meeting, students were divided into several groups and distributed project assignments to be made in each group. LKPD (student worksheets) were distributed to each group and explained the stages of making static fluid projects using youtube auxiliary media. Then guidance is given to each group to plan the project (tools and materials, making steps, and project design) using the assistive media Youtube. After that, each group presented the results of their project planning. Then, guided each group to determine the project schedule. At the end of the learning activity, each group was tasked with making videos related to doing projects, then uploading them to YouTube, and preparing project presentations at the next meeting (Anggraini & Wulandari, 2020).

In the third meeting, each group presents its project results and conducts discussions between groups. Furthermore, by monitoring project-making activities through YouTube, researchers provide an assessment of the project and each group's presentation. The following are the project results of each group presented in Figure 1.
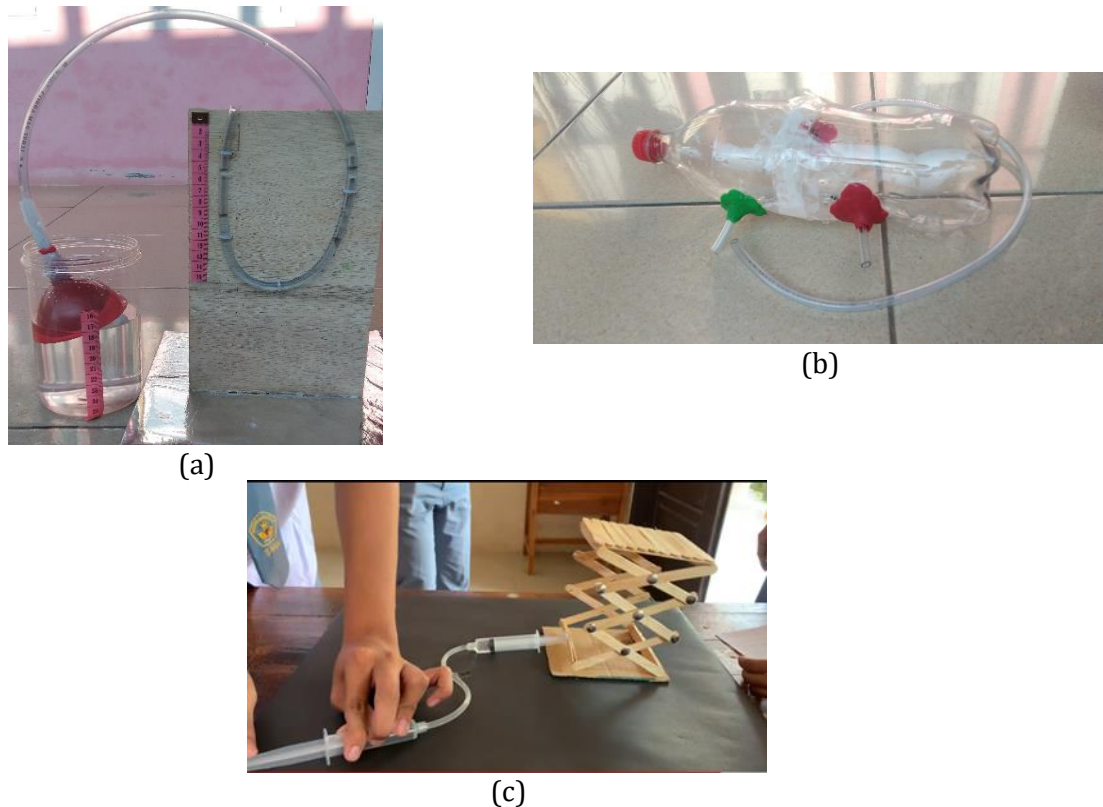
(a)

(b)

(c)

Figure 1. Project Result (a) Group 1: Hurtle Plane on Hydrostatic Pressure Material (b) Grup 2: Simple Hydraulic Jack Material on Pascal's Law (c) Group 3: Simple Chaff Material on Law Of Archimedes.

The next stage of learning is that the researcher asks students to conclude related to learning activities about static fluids. At the end of the learning, students were asked to do posttest questions on critical thinking skills and self-confidence questionnaires to see the ability of students after being given treatment (Nirmayani & Dewi, 2021).

The learning process in the control class uses STAD-type cooperative learning. The first meeting began with providing pretests as essay questions to students, followed by conveying goals and providing motivation. Then divide student groups into several groups and distribute LKPD (Student Worksheets). Where students prepare tools and materials to do a practicum in the next meeting. In the second meeting, students conducted a practicum on hydrostatic pressure, Pascal's law, and Archimedes' law. After completing the practicum, each group discussed and drew conclusions related to the practicum. In the third meeting, students did posttest questions on critical thinking skills and self-confidence questionnaires to determine the extent of student's critical thinking skills and self-confidence after treatment.

Data collection is carried out by conducting a pretest before learning takes place and a posttest after learning is completed both in experimental and control classes. The way to determine whether or not there is an influence of the PjBL learning model assisted by YouTube is by comparing the results of the achievement of students' critical thinking skills tests between the experimental and control classes. The following are the results of the critical thinking skills test, presented in Table 4.

Table 4. Test Results to Critical Thinking

Class	Pretest		Posttest		Average Score	
	X_{max}	X_{min}	X_{max}	X_{min}	Pretest	Posttest
Experimental	60	32	96	68	44,57	82,14
Control	48	20	88	64	39,14	77,14

Based on the pretest results of critical thinking skills, the average score of the experimental class was 44.57, and the average score of the control class was 39.14. From the data, the average pretest score of the experimental class and the control class is still below KKM (Minimum Completeness Criteria) because the two classes have not been given treatment. Then, based on the results of the critical thinking skills posttest, the average score of the experimental class was 82.14, and the average score of the control class was 77.14. From the data, the experimental and control classes' average posttest scores are above KKM (Minimum Completeness Criteria) because both classes have been treated. Based on these data, it was found that the experimental class's average pretest and posttest scores were higher than the control class's average pretest and posttest scores. From the difference in treatment between experimental classes using the YouTube-assisted PjBL learning model, there was more improvement than the control class. Therefore, the YouTube-assisted PjBL learning model affects students' critical thinking skills. The following table 5 shows the results of student self-confidence.

Table 5. Results of the Self-Confidence Questionnaire

Class	Average Rating	Criterion
Experiment	75,11	High
Control	66,43	Medium

Based on the results of the self-confidence questionnaire, the average score of the experimental class was 75.11 with high criteria, while the average score of the control class was 66.43 with medium criteria. Based on these data, it was found that the average self-confidence value of the experimental class was higher than the average self-confidence value of the control class. From the difference in treatment between experimental classes using the YouTube-assisted PjBL learning model, there was more improvement than the control class. So the YouTube-assisted PjBL learning model affects students' self-confidence.

This increase is caused when the educator's learning process motivates students to have confidence in the abilities possessed by students. After being motivated, the educator also gives students a problem to solve according to the predetermined time. When students have confidence in their abilities, then these students can solve the problems given. When in experimental classes, almost all students can solve the problems given. This situation arises because students use the PjBL learning model assisted by YouTube.

Only a few students in the control class feel enthusiastic or confident in their abilities because the control class applies the STAD-type cooperative learning model. Most students do not understand the material delivered because they rely on other group members, so they are less confident in their abilities. Based on the explanation above, it can be concluded that the PjBL learning model assisted by YouTube in the experimental class results in critical thinking skills and self-confidence higher than the STAD-type cooperative learning model.

The researcher conducted a hypothesis test to determine the effectiveness of the PjBL learning model assisted by YouTube. Before conducting a hypothesis test, a prerequisite analysis test was carried out, which included a normality test and a homogeneity test in the SPSS version 25 program. The test used the Kolmogorov-Sminorv on SPSS version 25 with a significant level of 0.05. If the significance value is higher than 0.05, the data is normally distributed; if the significance value is less than 0.05, then the data is not normally distributed (Siregar, 2015). The results of the pretest and posttest normality tests of the experimental class and control class and self-confidence can be seen in Table 6.

Table 6. Normality Test Results

	Class	Kolmogorov-Smirnov[a]			Information
		Statistic	df	Sig.	
Pretest	Experiment	.138	28	.186	Normal
	Control	.150	28	.056	Normal
Posttest	Experiment	.117	28	.200[*]	Normal
	Control	.144	28	.145	Normal

	Class	Kolmogorov-Smirnov[a]			Information
		Statistic	df	Sig.	
Self	Experiment	.112	28	.200[*]	Normal
Confidence	Control	.158	28	.072	Normal

Table 6 shows that the experimental class pretest data significantly differed from the control class by 0.186 and 0.056. The experimental class's posttest data had a significance of 0.200, while the control class's data had a significance of 0.145. The experimental class's self-confidence data was significant at 0.200, while the control class was significant at 0.072. Because the significant magnitude between the experimental class and the control class on the pretest, posttest, and self-confidence after the normality test was greater than 0.05, it can be concluded that the two classes are normally distributed.

The homogeneity test was performed using SPSS version 25 with a significant level of 0.05. The distributed data is not homogeneous if the significance value is higher than 0.05 (Widianto, 2010). The results of the pretest, posttest, and self-confidence homogeneity tests can be seen in Table 7.

Table 7. Homogeneity Test Results

	Levene Statistic	df1	df2	Sig.	Description
Pretest	0,002	1	54	0,780	Homogeneous
Posttest	0,387	1	54	0,537	Homogeneous
Self-confidence	1.230	1	54	0,654	Homogeneous

Table 7 shows that the pretest critical thinking skills score was 0.780, the posttest critical thinking skills score was 0.537, and the self-confidence score was 0.654. The significant magnitude of the pretest, posttest, and self-confidence results after the homogeneity test is greater than 0.05, indicating that the results are homogeneous.

The research hypothesis test is carried out after calculating the prerequisite analysis tests, namely the normality and homogeneity tests. After passing the preloaded test calculation, the analysis will continue using the Multivariate Of Variance (MANOVA) test. The purpose of the researcher conducting a hypothesis test is to determine whether or not there is an influence of the PjBL learning model assisted by YouTube on the ability to think critically and self-confidence of students in physics learning. The results of the acquisition and calculation of the MANOVA test in the SPSS program version 25 with a significant level of 0.05 can be seen in Table 8.

Table 8. Hypothesis Test Results

Source	Dependent Variable	df	Mean Square	F	Sig.
Corrected Model	Critical Thinking	1	350.000	7.539	.008
	Self Confidence	1	1089.446	37.613	.000
Intercept	Critical Thinking	1	355207.143	7651.487	.000
	Self Confidence	1	279039.446	9633.694	.000
Treatment	Critical Thinking	1	350.000	7.539	.008
	Self Confidence	1	1089.446	37.613	.000

The hypothesis test was performed using the MANOVA test. If the significance value is lower than 0.05, H0 is rejected, and H_1 is accepted. However, if the significance value is higher than 0.05, H0 is accepted, and H_1 is rejected. In Table 8, the critical thinking gets a significance value of 0.008 (lower than 0.05). Therefore, H_1 is accepted, and H_0 is rejected, which means there is a difference between the two samples used after getting treatment from researchers. In this study, the average score of the experimental class obtained higher results than the control class. Thus, the PjBL learning model assisted by YouTube affects critical thinking skills.

In Table 8, self-confidence gets a significance value of 0.000 (lower than 0.05). Therefore, H_0 is rejected, and H_1 is accepted, which means there is a difference between the two samples used after

getting treatment from researchers. In this study, the experimental class scores obtained higher results than the control class. So it can be implied that the PjBL learning model assisted by YouTube affects self-confidence. So, based on the description of the calculation and analysis results above, it can be concluded that the YouTube-assisted PjBL learning model influences students' critical thinking skills and self-confidence in physics learning with an average experimental class score higher than the control class.

This study's findings align with research (Adekantari et al., 2020; Sularmi et al., 2018), which reveals that the Project Based Learning Model can improve critical thinking skills. Through PjBL, students can come up with their ideas through project activities. However, this research only looks at the effect on critical thinking skills. The ability closely related to critical thinking, namely self-confidence, is uncertain. Other studies have also revealed that PjBL plays an important role in improving critical thinking skills and students' collaboration skills (Trisdiono et al., 2019). The ability of student collaboration increases because, during the learning process with PjBL, it is done in groups. From previous research, the novelty of the findings of this study revealed that YouTube-assisted PjBL also affected student self-confidence.

CONCLUSION

YouTube-assisted PjBL learning model affects the critical thinking skills and self-confidence of students. This is evidenced by the results of the hypothesis test using the MANOVA test for critical thinking skills obtained a significant value of 0.008, and self-confidence obtained a significant value of 0.000. This result shows a significant value < 0.05, so H_0 was rejected and H_1 accepted. Furthermore, it is recommended to educators or prospective educators to do alternative learning, one of which is by using the YouTube-assisted PjBL learning model to affect students' critical thinking skills. From the results of this study, further research can also be held on learning with a project-based learning (PjBL) model using different media, concepts, or topics.

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