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Implementation of a media-based citizen science project learning model using a scientific approach in Civic Education to enhance student critical thinking skills

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Abstract
Pancasila and Citizenship Education (PCE) are crucial for developing active, critical, and responsible citizens. Critical thinking is a key competency students should acquire through PCE. This study aims to analyse and evaluate the effectiveness of the Project Citizen learning model utilising a Scientific Approach in enhancing students' critical thinking skills. The long-term objective is to provide junior high school teachers with examples of innovative learning models applicable to all subjects and recommend to relevant agencies to implement the Project Citizen model in PCE to boost critical thinking abilities. This research focuses on creating effective learning models and frameworks for instilling character values in schools. Using a quantitative quasi-experimental design, the study's population consists of all Public Junior High School 3 Kendari students, with a sample drawn from two eighth-grade classes. Data collection involved attitude scale questionnaires, observations, and interviews. Statistical methods were used for quantitative data analysis, while qualitative data were analysed descriptively. The analysis included normality tests, homogeneity tests, comparisons of means, and calculations of normalised gains. Hypothesis testing revealed a significant difference in the effectiveness of the Project Citizen model based on the Scientific Approach compared to conventional teaching methods in improving critical thinking skills at Public Junior High School 3 Kendari.

Keywords: critical thinking; project citizen; scientific aproach

Introduction

Pancasila and Citizenship Education (PCE) is crucial in shaping students into active, critical, and responsible citizens. Critical thinking skills are one of the competencies that must be developed in PCE learning. This ability allows students to analyse, assess, and review information and ideas they encounter daily. Students can develop critical, logical, and reflective attitudes towards various social, political, and moral issues with this ability. However, many students still have difficulty in honing their critical thinking skills.

PCE learning that only focuses on theory and conceptual understanding is often less effective in developing students' critical thinking skills because it needs to link the material to real contexts. This approach can make students less involved and make applying the concepts learned in everyday situations difficult. To overcome this problem, a more active and contextual learning method is needed to connect theory with practice. Research by Longhofer et al. (2019) demonstrates the importance of a project-based approach in increasing student engagement. Mirra & Garcia (2022) emphasise making learning more relevant to students' social contexts. In addition, Domínguez et al. (2024) highlight how a problem-based approach can facilitate active student engagement in the learning process, thus more effectively developing critical thinking skills.

In the current digital era and the development of information technology, media plays a crucial role in the learning process, serving as a tool that enriches the learning experience and increases the accessibility of information. Zahedi et al. (2023) emphasizes how the integration of technology and digital media in education can broaden the scope of learning by providing more varied and interactive resources, allowing students to engage more deeply in their learning process. Berger (2015) also shows that media, including digital platforms, can support different learning styles and help personalise learning experiences, increasing teaching effectiveness. Meanwhile, Kim et al. (2011) underline that using digital media in education enriches learning materials and facilitates better collaboration and communication between students and teachers. By utilising media optimally, the learning process can be more dynamic, engaging, and relevant to the needs and interests of today's students.

Utilising media in learning can help students understand abstract concepts better and develop critical thinking skills by exploring various available sources of information. One learning model that can be applied is the Project Citizen Learning Model. Eliza et al. (2024) emphasise that media in learning has multifunctional benefits. Longhofer, et al. (2019) highlighted that project-based learning, such as Project Citizen, allows students to be actively involved in solving real problems and linking theory to practice, which can significantly improve their critical thinking skills. By applying media and technology in this model, students

get information from various sources and learn how to analyse and construct arguments based on the data obtained. In addition, Domínguez et al. (2024) show that a scientific-based approach to learning, which emphasises investigation and analysis, can deepen students' understanding of the material and improve their critical thinking ability.

In the context of PCE learning, the main challenge faced is the lack of effective methods in improving students' critical thinking skills. Cahyono et al. (2024) highlighted that many currently applied learning approaches still need to optimally stimulate students' analytical skills, often because the methods do not involve elements that support in-depth exploration and evaluation. This indicates the need for more innovative approaches to overcome this weakness. Kim et al. (2011) show that integrating technology and project-based or problem-based learning methods can increase student engagement and facilitate deeper critical thinking. By utilising technology and active learning methods, students can more easily connect theory to practice, analyse issues more critically, and develop the thinking skills needed to understand and address civic issues effectively.

Many current learning approaches still rely on traditional methods that often do not encourage students to explore civic issues in depth, reducing their engagement and understanding of the topic. Berger (2015) suggests that conventional methods focus on one-way information delivery, which limits student interaction and critical reflection. Meanwhile, Zahedi et al. (2023) emphasise the importance of technology integration and more active learning approaches to address these shortcomings by providing students with opportunities to engage in relevant projects and facilitating deeper exploration. By adopting more innovative and media-based methods, learning can become more dynamic and increase student engagement in complex citizenship issues.

Implementing the Project Citizen Learning Model based on a Scientific Approach to media offers a potential solution to overcome the problem of the lack of effective methods for improving students' critical thinking skills. Mirra and Garcia (2022) emphasise that this model combines a project-based approach with media integration and scientific approaches, which allows students to be actively involved in the learning process. Using digital media, students can access information from various sources and apply scientific methods to analyse data and solve relevant problems. This model enriches the learning experience by providing a more real and interactive context and facilitates critical thinking skills through in-depth exploration and project-based problem-solving. This model utilises digital media and scientific approaches to provide a more interactive, evidence-based learning experience.

This study contributes significantly to the science of PCE by introducing and testing a project-based learning model using scientific approach media. The main contribution of this study is developing an innovative model that integrates digital media and scientific methods to enhance students' engagement and critical thinking skills. By emphasising the use of digital media and a holistic evaluation approach, this study not only broadens the understanding of PCE learning practices but also provides practical guidance for classroom implementation. In addition, the findings offer valuable recommendations for educational policy, encouraging curriculum improvement to emphasise critical thinking skills development through project-based methods.

Method

The research method applied in this research is quantitative. According to Sugiyono (2018), quantitative research is a research method based on the philosophy of positivism to study a particular population or sample, and sampling is done randomly with data collection using instruments and statistical data analysis. The type of quantitative research used is a quasi-experiment with a Non-Equivalent Pre-Test-Post-Test Control Group Design. The research design can be described in Table 1.

Table 1.
Non-Equivalent Pre-Test Post-Test Control Group Design

Group	Pre-Test	Treatment	Post Test
Experimental	X	M-1	X
Control	X	M-2	X

Description:
X = Pretest and Posttest
M-1 = Treatment of Application of Project Citizen Learning Model
M-2 = Media Scientific Aproch

This study's population included all Public Junior High School 3 Kendari students, while the research sample consisted of grade VIII students. The sampling technique used was purposive sampling. Data collection techniques applied in this study included Questionnaires, Observations, and Interviews. Data analysis techniques in this study aimed to answer the problem formulation and test the hypothesis. Quantitative data were analysed using statistical methods, while qualitative data were analysed descriptively. The data analysis process involved several stages: normality test, homogeneity test, two-mean difference test, and normalised gain calculation.

Result and Discussion

The hypothesis in this study was tested using parametric statistics paired t-test. The following table shows the results of the pre-test data normality test of the environmental care attitude questionnaire to evaluate the normality of data distribution.

Table 2.
Result of Pre-Test Normality Test

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Control Esperiment	Static	df	Sig	Statistic	df	Sig.
Pre_test	Pre-test	,093	40	,200*	,974	40	,475
Experiment	Experiment	,108	40	,200*	,962	40	,192

From the table above, the results of the normality test for the final measurement (post-test) in the experimental class and the control class using the Kolmogorov-Smirnov test with the help of SPSS for Windows version 2.00 show a statistical value of 0.200. Because the significance value is more significant than 0.05, it can be concluded that the data from the final measurement of environmental care attitudes in both classes—the experimental and control classes—are normally distributed. Rubin (2007) explains that this normality test is essential to ensure the validity of further statistical analysis.

Once the data is known to be normally distributed, the next step is to conduct a homogeneity test to ensure that the variances between the groups being compared are the same, so that comparative analysis can be carried out accurately.Bartoletti & Faccioli (2016) emphasizes that the homogeneity test is important to validate the assumptions required before applying further statistical tests, such as t-test or ANOVA, to ensure valid and reliable results. If the data is not normal, the homogeneity test is not necessary. This test determines whether the data variance in the experimental and control classes is the same (homogeneous). The homogeneity test uses Levene-telit and is analysed using SPSS version 2.00. Data is considered homogeneous if the significance value in the Levene test is > 0.05. The results of this test are summarised in Table 3.

Table 3.
Result of Experimental Class Homogenity Test

Levene Statistic	df1	df2	Sig.
2,696	1	78	,105

Based on the results of the Levene Test Table 3, it can be interpreted that the Levene test output value of 0.105 indicates more than the specified alpha of 5% (0.05), so it can be concluded that the pre-test data for the Experimental and Control classes have the same or homogeneous variance. While the results of the homogeneity test for the Control class can be seen in table 4.

Table 4.
Results of the Control Class Homogenity Test

Levene Statistic	df1	df2	Sig.
,026	1	78	,872

Based on the results of the Levene test in Table 4, it can be interpreted that the output value of 0.872 indicates more than the specified alpha of 5% (0.05), so it can be concluded that the post-test data for the Experimental and Control classes have the same or homogeneous variance. The Project-Based Learning Model at Public Junior High School 3 Kendari was implemented for six three-week meetings, each lasting two lesson hours. At the first meeting, the teacher explained the basic learning concepts. Jover and Gozálvez (2024) show that introducing learning concepts and objectives is essential to setting students' expectations and preparing them for active engagement. Furthermore, Yu & Lai (2022) emphasised that the initial stages, such as apperception and explanation of the theme, are key to building students' understanding of the topic to be studied, in this case, human interaction with the environment, facilitating more effective and directed learning. After the pre-test, students conducted a question-and-answer and observed the school environment related to cleanliness and beauty.

In the learning process, teachers use media such as PowerPoint slides to motivate students and ask questions that stimulate critical thinking. Bobkowski & Miller (2016) underlined that visual media such as PowerPoint can increase student engagement by providing clear and interesting information. The projects included school cleanliness research, environmental campaigns, waste sorting practices, classroom garden creation, and student work exhibitions. During the projects, the teacher facilitated and supervised the projects' implementation and assisted the students. The projects were prepared for exhibition in the fourth meeting, and students from other classes were invited to see the work. Students presented reports on the results of their group work, and the teacher provided feedback and concluded the learning outcomes. Finally, students took a post-test and filled out a questionnaire in response to the

The control class research was conducted on students in grades VII-5 with the theme of dynamics of human interaction with the environment. The learning model was problem-based learning, implemented for six meetings (3 weeks), each lasting 2x45 minutes. In the first meeting, the teacher prepared students psychologically and physically, checked attendance, and conveyed the objectives and outline of the material. The teacher then explored students' basic knowledge of the environment using PowerPoint slides and asked questions about the school environment's cleanliness, beauty, and tidiness. The teacher raised problems with the school environment, such as scattered garbage and graffiti, and motivated students to collect information and make active observations. In the second meeting, the teacher and students designed a work structure to analyse the problem and divided the class into small groups. The third to fifth meetings were used to present observation results and solutions from each group..

Before implementing the project-based learning model in the experimental class and other learning models in the control class, an analysis was conducted to compare the initial measurement data (pre-test) of students' attitudes toward environmental concerns in both groups. A recapitulation of the average pre-test and post-test results of students' attitudes toward environmental concern in the experimental and control classes, before and after treatment, can be seen in Table 5.

Table 5.

Average Pretest and Posttest Scores of Experimental Class and Control

Class	Initial Measurement (Pre-Test)	Final Measurement (Post-Test)	Average Score Change
Experiment	123,40	132,35	8,95
Control	126,20	130,88	4,68

Based on the data in the table above, there is a change in the average score in the experimental and control classes after learning. The biggest change occurred in the experimental class, with an average of 8.95. Data analysis using the Independent Samples T-Test with SPSS showed that before the treatment, there was no significant difference in students' concern for the environment between the two classes. The t-test result is -1.097 with a significance value (2-tailed) of 0.276. With a t-table $of 1.990 ($\alpha = 0.05$, $df = 78$), the t-test result <t-table. This shows no significant difference in students' attitudes toward environmental concern between the experimental and control classes before treatment. After implementing the project-based learning model in the experimental class and the problem-based learning model in the control class, an analysis was conducted to compare students' concern attitudes based on the post-test results.

The next step is to calculate the gain (increase) in students' concern attitudes by comparing the pretest and posttest. Gain is calculated using the gain normalization formula from Hake (1999):

$$N(g) = \frac{\text{Posttest score-Pretest score}}{\text{Maximum score – Pretest score}}$$

The analysis shows an increase in student awareness in the experimental class after implementing the project-based learning model, with the category of gain increase h of 25 people (62.5%), g of 13 people (32.5%), and the high category of 2 people. Hypothesis testing was carried out using paired sample t-test and independent sample t-test using SPSS version 2.00 to compare the mean pretest and posttest in the experimental class.

Implementing the Citizen Project Learning Model based on media with a scientific approach in citizenship education has proven effective in improving students' critical thinking skills. By utilising digital media as a tool, this model allows students to be actively involved in exploring and analysing citizenship issues and connecting theory with practice through relevant projects. The scientific approach applied in this model deepens students' understanding of the material and encourages them to develop arguments based on the data and facts found. The results show that this model enriches the learning experience and significantly improves students' critical thinking skills, preparing them to become more informed and analytical citizens.

Conclusion

This study shows that PCE learning at Public Junior High School 3 Kendari still needs to improve in encouraging students to be active, creative, and student-centred. Conventional methods that have been used tend to focus on delivering concepts and final academic values, while aspects of attitudes and skills that are important for building students' concern for the environment should be addressed. This results in the inability of these methods to overcome less caring behaviour such as littering and vandalism. In contrast, project-based and problem-based learning in this study proved more effective in increasing students' concern for the environment.

Both models facilitate active interaction and student involvement, with project-based learning providing real experiences and problem-based learning focusing on problem-solving. Although both are effective, an approach that integrates knowledge, attitudes, skills, and social actions has significantly impacted students' concerns. The recommendation from the results of this study is the Integration of Innovative Learning Models. Schools should consider integrating

project-based and problem-based learning models into the Civics curriculum. The application of these models can provide a more interactive and practical learning experience and encourage students to be more actively involved in activities related to environmental concerns. It is recommended that civics teachers receive specific training on project-based and problem-based learning methods. This training will help them understand how to effectively apply these models in the classroom and manage more active learning dynamics.

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