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Effectiveness of a Project Based Learning Model Integrated With Sasambo Local Wisdom to Enhance Students' Scientific Attitudes

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Abstract. The primary issue in higher education is the low level of scientific attitudes among students, which include curiosity, open-mindedness, and environmental sensitivity. One approach to addressing this problem is through the project based learning (PjBL) model integrated with local wisdom. This study aims to measure the effectiveness of the PjBL integrated sasambo local wisdom model, which incorporates values such as cooperation, respect for nature, and social harmony, in enhancing students' scientific attitudes. The study employed a quasi-experimental design with a one-group pretest-posttest approach. The research subjects consisted of 70 students from Muhammadiyah Mataram University and Hamzanwadi University. Data were collected using a scientific attitude questionnaire with five indicators: curious attitude, respect for facts, an open-minded attitude, perseverance, and sensitivity toward the environment. The data were analyzed using normalized N-gain to measure the improvement in scientific attitudes and inferential statistical tests to assess the significance of the results. The findings reveal that the sasambo integrated PjBL model effectively improves students' scientific attitudes. The average N-gain was categorized as high (0.81 and 0.83) at both universities. Among the indicators, sensitivity toward the environment showed the greatest improvement, while respect for facts showed moderate improvement. Statistical tests indicated a significant difference between pretest and posttest scores, with consistent results across both universities. In conclusion, the the PjBL integrated sasambo local wisdom model significantly and consistently enhances students' scientific attitudes. This model holds potential as a culturally relevant innovative strategy for improving the quality of science education and fostering students' character development.
Keywords: Project based learning, sasambo local wisdom, Scientific Attitudes

Introduction

The quality of education is a key factor in determining a nation's competitiveness and development level. In higher education, efforts to improve the quality of learning are essential to prepare students with competencies in skills, knowledge, and attitudes required

to address various complex challenges in the real world (González-Salamanca et al., 2020). One primary focus is the development of scientific attitudes, which are essential for students to think critically, solve problems effectively, and conduct research optimally. One promising instructional model for cultivating these skills and attitudes is project based learning (PjBL). PjBL is characterized by an experiential learning approach in which students gain knowledge through active exploration of real world (Omelianenko & Artyukhova, 2024). This model has proven effective in enhancing deep understanding, increasing student engagement, and developing 21st-century skills, including collaboration, communication, and critical thinking (Almazroui, 2023).

The successful implementation of PjBL requires contextual adaptation to meet the local needs and characteristics of students. A standardized approach may not always yield the expected results, as cultural context and local wisdom play crucial roles in shaping students' attitudes and behaviors. Therefore, integrating local wisdom into the PjBL model has the potential to enhance learning experiences and outcomes, particularly in the development of attitudes (Parmiti et al., 2021). In recent years, the integration of local wisdom into educational practices has gained increasing attention. Local wisdom, which encompasses a set of values, norms, and traditions, can serve as a rich resource for reinforcing cultural identity and deepening students' social emotional connections with their learning environment. In Indonesia, the local wisdom of Sasambo, representing the cultural heritage of the Sasak, Samawa, and Mbojo (Sasambo) tribes in West Nusa Tenggara, is a valuable asset for educational innovation. Sasambo wisdom includes various values and principles such as cooperation, respect for nature, and social harmony. These values are not only relevant for personal and social development but also align with scientific attitudes like curiosity, perseverance, and ethical considerations in research (Sahira et al., 2023). Integrating Sasambo wisdom into the PjBL model can thus offer a unique learning experience that bridges scientific inquiry with local cultural values. Although the potential benefits of this integrative approach are considerable, research on the integration of local wisdom into project based learning remains limited. Systematic studies are needed to explore how local wisdom can be effectively incorporated into PjBL and how it influences the development of students' scientific attitudes. Addressing this gap is essential to ensure that the developed learning model is not only pedagogically robust but also culturally relevant.

Although previous studies have highlighted the benefits of PjBL in developing 21st-century skills (Almazroui, 2023), research integrating local wisdom, such as sasambo, into this model remains very limited. This study offers an innovative approach by incorporating sasambo cultural principles into PjBL, which is expected not only to enhance students' scientific attitudes but also to strengthen the contextual relevance of learning (Parmiti et al., 2021). However, further exploration is needed regarding the effectiveness of this integration in shaping students' scientific attitudes, an aspect that has not been widely studied in the current literature (Fong et al., 2023; Brown et al., 2021).

This study aims to examine the effectiveness of a PjBL model integrated with sasambo local wisdom in enhancing students' scientific attitudes. This model is designed to facilitate a learning process that not only engages students in scientific inquiry but also instills values rooted in local culture. Through this approach, students are expected to develop a holistic understanding of science that goes beyond cognitive learning and includes socio-cultural aspects. The primary focus on developing scientific attitudes stems from the significant influence these attitudes have on students’ approaches to learning and conducting research. Scientific attitudes, such as open-mindedness, skepticism, and objectivity, are essential foundations for successful scientific inquiry and play a crucial role in preparing students for research and professional careers (Sanchez, 2022). Therefore, fostering these attitudes is a key component of higher education. Integrating sasambo local wisdom is expected to enhance student engagement and motivation by providing a contextually

relevant learning experience. When students feel that the learning content aligns with their cultural identity, they are more likely to experience a sense of connection and personal relevance, which in turn can positively impact their attitudes and learning outcomes (Fong et al., 2023; Brown et al., 2021).

This study makes a significant contribution to the field of educational innovation through the development of a learning model that is responsive to cultural contexts. The proposed model integrates sasambo local wisdom with a project based pedagogical approach that has proven effective. This integration is expected to make the learning process more contextual, relevant, and engaging for students, thereby encouraging active participation and involvement. By considering aspects of local culture, this learning model not only emphasizes academic outcomes but also fosters an appreciation of cultural identity, which is a crucial element in shaping students' character (Brown, 2017; Hikmawati et al., 2020; Suprapto et al., 2021). Additionally, the findings from this study are expected to provide insights and guidance for educators, policymakers, and researchers focused on implementing education based on local wisdom. In this context, the proposed approach offers an adaptable alternative for diverse educational environments with varying cultural backgrounds. By combining the strengths of modern pedagogy and local wisdom, this model aims to create education that is both culturally and academically relevant, addressing the complex challenges of the global era (Sharma, 2024; Hidayat et al., 2023). This aligns with the primary goal of education: to cultivate a generation that excels academically while possessing a profound understanding of their cultural roots and social context (Darling-Hammond et al., 2020).

The effectiveness of the PjBL model integrated with sasambo local wisdom aims to create a more meaningful and holistic learning experience, particularly in enhancing students' scientific attitudes. By connecting scientific concepts with cultural values familiar to students, this model facilitates a balanced learning process that supports the development of knowledge, scientific thinking skills, and an understanding of local wisdom. Through this approach, students can build strong academic competencies while preserving their cultural identity, making them better prepared to adapt and contribute to diverse and dynamic environments, both locally and globally.

Methods

The research utilized a quasi experimental approach. Quasi experimentation is a type of research approach used to measure the impact of an intervention or treatment on specific variables (Creswell & Creswell, 2018). The study employed a one-group pretest-posttest design, a form of experimental research design used to evaluate the effectiveness of an intervention or treatment on a particular group without a control group.

Table 1. Treatment on a particular group without a control group

Class	Pretest	Treatment	Posttest
Class 1 UMMAT	O1	X	O2
Class 2 Hamzanwadi University	O1	X	O2

Information:
O1 = Pre test
O2 = Post test
X = Intervensi

In this design, a single group of subjects is given a pretest to measure baseline conditions before a specific treatment or intervention is applied. Following this, the treatment is implemented, and at the end of the intervention period, a posttest is administered to measure any changes resulting from the treatment. This design is used to assess the effectiveness of the intervention by comparing pretest and posttest results within the same group.

The subjects in this study were 35 students from the primary school teacher education program at UMMAT and 35 students from Hamzanwadi University. The data collection instrument used was a questionnaire. The scientific attitude questionnaire measured students' attitudes before and after the intervention of the model. Questionnaires were given to students before and after implementing the model in the science concepts course. The questionnaire consisted of statements with indicators of scientific attitudes, including a curious attitude, respect for facts, an open-minded attitude, perseverance, and sensitivity toward the environment.

The scientific attitude data of the students were analyzed based on questionnaire data collected before and after the model intervention. The increase in scientific attitudes was determined by calculating the percentage of normalized N-gain, which indicates the effectiveness of the treatment. Subsequently, the pretest, posttest, and N-gain data for scientific attitudes were further analyzed using inferential statistical tests with the help of SPSS, supported by descriptive qualitative analysis.

There were two analyses to test the effectiveness of the Sasambo integrated PjBL model: (1) an analysis to test the significant difference between the mean pretest and posttest scores of scientific attitudes before and after implementing the sasambo-integrated PjBL model, using a paired sample t-test. The research hypothesis tested was as follows: there is no significant difference between the pretest and posttest scores of students' scientific attitudes who used the model (H0). (2) A difference test to assess the impact and consistency of the sasambo-integrated PjBL model in improving students' by testing the significant difference in the mean scientific attitude scores across two classes using the model, employing an independent t-test. The research hypothesis tested was as follows: there is no significant difference in the mean N-gain scores of scientific attitudes for the two classes using the sasambo-integrated PjBL model (H0).

Results and Discussion

Data on students' scientific attitudes were obtained through a questionnaire administered before (pretest) and after (posttest) the implementation of the Sasambo-integrated PjBL model in the experimental class. The pretest scores, posttest scores, and the improvement in students' scientific attitudes are presented in Table 2.

Table 2. Summary of pretest scores, posttest scores, and improvement in students' scientific attitudes

Description	UMMAT		Hamzanwadi University	
	Pretest	Posttest	Pretest	Posttest
Highest score	62	92	67	94
Lowest score	48	64	32	68
Average score	52.47	88.43	49.72	88.14
Average N-gain	0.81		0.83	
Number of students	35		35	
High N-gain	27 (77.14%)		29 (82.85%)	
Moderate N-gain	18 (22.86%)		16 (17.15%)	
Low N-gain	0		0	

The analysis of the scientific attitude indicators was conducted based on the average score for each indicator. The N-gain analysis results for each scientific attitude indicator are presented in Figure 1.

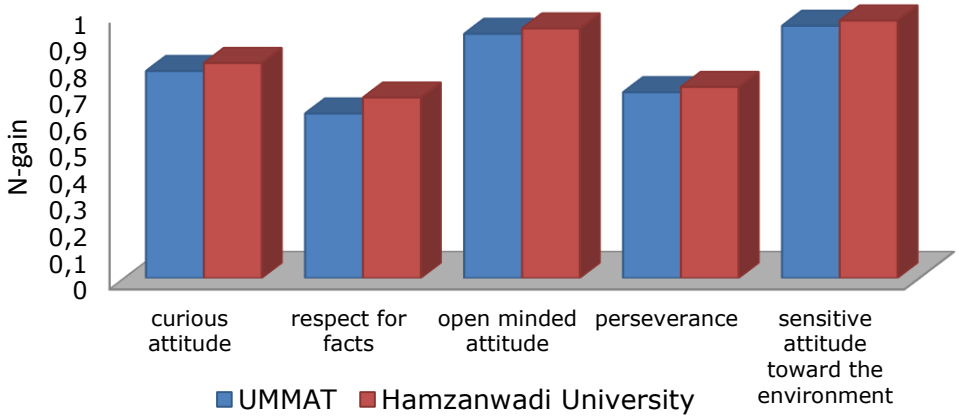

Figure 1. N-gain Data of Scientific Attitudes for Each Indicator

Based on the data in Table 2, there was an increase in students' scientific attitudes in both the UMMAT and Hamzanwadi University classes, with mean N-gain scores of 0.81 and 0.83, respectively. The highest increase among scientific attitude indicators was in the sensitive attitude toward the environment, categorized as high, while the lowest increase was in the respect for facts indicator, which fell into the moderate category. Before conducting inferential statistical tests to assess the model's effectiveness, normality and homogeneity tests were performed as prerequisites to determine whether parametric or non-parametric statistical tests would be used. The results of the normality test on the pretest and posttest scores for students' scientific attitudes are presented in Table 3.

Table 3. Normality test results for pre-test and post-test scores of scientific attitudes

Data	Class	Shapiro-Wilk			
		Statistic	df	Sig	Conclusion
Pre-test	UMMAT	0.977	35	0.693	Sig > 0.05
	Hamzanwadi University	0.956	35	0.245	normally distributed
Post-test	UMMAT	0.937	35	0.057	Sig > 0.05
	Hamzanwadi University	0.943	35	0.107	normally distributed

The results of the normality test for pretest scores of scientific attitudes showed significance values of 0.693 and 0.245 for the UMMAT and Hamzanwadi University classes, respectively. For the posttest scores, the normality test results indicated significance values of 0.057 for the UMMAT class and 0.107 for Hamzanwadi University. All significance values for the normality tests on pretest and posttest scores were >0.005, indicating that all student scientific attitude score data were normally distributed. The paired sample t-test was conducted to analyze the difference in mean scores between the pretest and posttest scientific attitudes. The results of the paired sample t-test for the mean difference in pretest and posttest scientific attitude scores are presented in Table 4.

Table 4. Results of the mean difference test for pretest and posttest scores of scientific attitudes

Class	df	Sig (2-tailed)	Conclusion
UMMAT	34	0.000	Significance 0.000 < 0.050
Hamzanwadi University	34	0.000	(H0 is rejected)

Based on the mean difference test data for pretest and posttest scores of scientific attitude skills in the experiment, as shown in Table 3, the Sig (2-tailed) value is < 0.005, indicating that H0 is rejected. This means that the posttest scores are significantly higher than the pretest scores in the experiment. These results demonstrate that the Sasambo integrated PjBL model effectively improves students' scientific attitudes.

The consistency of the sasambo integrated PjBL model implementation in improving students' scientific attitudes was tested by examining the significance difference in the mean N-gain scores from the experimental groups. To test this, a parametric statistical test was used, specifically the Independent sample t-test, as the prerequisite tests were met, meaning the N-gain data for scientific attitudes were normally distributed and homogeneous. A summary of the results from the consistency test on the improvement of scientific attitudes is presented in Table 5.

Table 5. Results of the consistency test for the improvement of scientific attitudes

Statistical test	Class	Sig	Conclusion
Normality tes (Shapiro-wilk)	UMMAT	0.071	Sig > 0.050 (normal)
	Hamzanwadi University	0.068	
Homogeneity test	UMMAT and Hamzanwadi University	0.132	Sig > 0.050 (homogen)
Independent sample t test	UMMAT and Hamzanwadi University	0.178	Sig > 0.050 (H0 diterima)

The consistency test results in Table 5 for the UMMAT and Hamzanwadi University classes indicate that the normality and homogeneity prerequisite tests were met, as the significance values (Sig) were > 0.05. The hypothesis testing results using the independent sample t-test showed a Sig value > 0.05, meaning there was no significant difference in the improvement of students' scientific attitude skills between the two experimental classes. Based on these results, it can be concluded that the sasambo integrated PjBL model is significantly effective in consistently improving students' scientific attitudes.

The integrated sasambo with PjBL model demonstrates a significant influence on improving students' scientific attitudes. The PjBL model emphasizes project based learning, providing students with opportunities to actively engage in solving real world problems within the learning process (Almulla, 2020; Evenddy et al., 2023). The integration of local culture, such as sasambo representing the cultural diversity of the West Nusa Tenggara region adds a relevant contextual element that enhances students' motivation and connection to the material being studied. Recent research indicates that cultural context can strengthen students' understanding by helping them see the direct relevance of academic knowledge to everyday life (Brown et al., 2019).

The integrated sasambo PjBL model has proven effective in improving post-test scores of students at UMMAT and Hamzanwadi University, with average scores reaching 88.43 and 88.14, respectively. This improvement reflects that students can achieve a deeper understanding and develop better scientific attitudes after engaging in culturally relevant PjBL. Culturally oriented PjBL not only strengthens academic concepts but also promotes the development of scientific attitudes, including openness to new ideas and

scientific curiosity (Markula & Aksela, 2022). Additionally, the high N-gain values (0.81 for UMMAT and 0.83 for Hamzanwadi University) confirm that this intervention is highly effective in enhancing scientific attitudes. The majority of students achieved high N-gain categories, with 77.14% at UMMAT and 82.85% at Hamzanwadi University, indicating that the integrated Sasambo PjBL model significantly improved students' scientific attitudes. These findings are consistent that PjBL with local cultural components can enhance scientific attitudes through collaborative and exploratory activities, encouraging students to work together on projects relevant to their cultural backgrounds (Parmiti et al., 2021).

The integrated Sasambo PjBL model also has the potential to build students' critical thinking and collaboration skills, which are essential aspects in developing scientific attitudes. PjBL enables students to develop critical thinking skills through investigation, data analysis, and reflective decision making processes (Grinnell, 2019; Waddington, 2017). In this context, the integration of sasambo helps students understand the material in real life contexts, thereby motivating them to apply knowledge scientifically and critically.

The data obtained from the N-gain analysis of scientific attitudes in Figure 1 shows results for several indicators, such as "curious attitude," "respect for facts," "open-minded attitude," "perseverance," and "sensitive attitude toward the environment," which fall into medium and high categories. This N-gain result reflects the extent of change in students' scientific attitudes after the intervention or training was administered. Higher N-gain values indicate a more significant improvement in attitude. Based on data from UMMAT and Hamzanwadi University, the "sensitive attitude toward the environment" indicator scored the highest, indicating a significant increase in students' environmental sensitivity at both universities. This finding aligns with existing literature that emphasizes the role of educational institutions in fostering environmental consciousness. For instance, studies have shown that curricula incorporating sustainability and environmental education significantly influence students' attitudes and behaviors towards ecological issues (Bergman, 2016). Furthermore, initiatives such as campus sustainability programs and community engagement projects have been linked to increased environmental sensitivity among students (Tabuenca et al., 2020). These results underscore the importance of integrating environmental education into higher education frameworks to cultivate a generation of environmentally responsible individuals.

In the comparative analysis of the indicators, it was observed that the "open-minded attitude" indicator also achieved a high N-gain value, indicating that students tend to become more receptive to new perspectives after the training. This is significant because an open-minded attitude enables students to accept and consider new information, which is a crucial element in scientific learning. Previous studies have stated that an open-minded attitude contributes to the enhancement of scientific attitude and the ability to solve complex problems (Price et al., 2015; Wahyudiati, 2022). Furthermore, the indicators of "respect for facts" and "perseverance" showed moderate improvement, suggesting that students are beginning to value facts more and exert greater effort in addressing scientific challenges. The importance of these attitudes in science learning is supported by research indicating that students with high perseverance and respect for facts tend to possess better analytical skills (Jones & Donaldson, 2022; Warfvinge et al., 2022; Fwu et al., 2018).

The data analysis results from Table 3 in this document show a significant difference between students' pretest and posttest scores on scientific attitudes in the trial of the PjBL model integrated with sasambo. Testing was conducted using a paired sample t-test, yielding a Sig (2-tailed) value of 0.000 for both universities (UMMAT and Hamzanwadi University). This significant value indicates that the null hypothesis (H0) is rejected, meaning there was a significant increase in posttest scores compared to pretest scores following the implementation of the PjBL model.

Previous studies support the effectiveness of the PjBL model in enhancing scientific attitudes, as it provides students with opportunities to engage directly in projects that require critical thinking and systematic problem solving (Lesman et al., 2023). This method also motivates students to collaborate and explore innovative solutions relevant to real life contexts, thereby improving their understanding of science (Graesser et al., 2018). Furthermore, the significant improvement in scientific attitudes following the PjBL intervention aligns with the theory that PjBL offers hands-on experiences, making scientific concepts more tangible and meaningful for students (Rehman et al., 2024). Through active interaction in projects, students develop scientific thinking skills such as curiosity, perseverance, and openness to scientific facts, all of which are essential for the development of higher academic skills (Lombardi et al., 2021).

Previous studies support that the PjBL model is effective in enhancing scientific attitude skills, as it provides students with the opportunity to engage directly in projects that require critical thinking and systematic problem solving (Monika et al., 2023; Krajcik & Czerniak, 2018). This method also motivates students to collaborate and explore innovative solutions relevant to everyday life, thereby improving their understanding of science(Koerniawati & Sintawati, 2024; Ibrahim & Rashid, 2022). Furthermore, the significant improvement in scientific attitudes following the PjBL intervention aligns with the theory that PjBL provides hands-on experiences (Saad & Zainudin, 2024), making scientific concepts more tangible and meaningful for students (Chang et al., 2024). Through active interaction in projects, students develop scientific thinking skills such as curiosity, perseverance, and openness to scientific facts, all of which are essential for the development of higher academic skills (Chalkiadaki, 2010).

The integrated sasambo PjBL model has consistently proven effective in enhancing students' scientific attitudes. Based on trial data, statistical test results indicate that the distribution of N-gain values for students' scientific attitudes at two universities, UMMAT and Hamzanwadi University, satisfies the criteria for normality and homogeneity. The Shapiro-Wilk test results show significance values above 0.05 for both universities, specifically 0.071 for UMMAT and 0.068 for Hamzanwadi, indicating that the data distribution is normal. Furthermore, the homogeneity test results reveal a significance value of 0.132, which suggests that the data from both universities are homogeneous.

The hypothesis testing using an independent sample t-test indicates no significant difference in the improvement of scientific attitude skills between students at the two universities. The obtained significance value of 0.178, which is greater than 0.05, confirms that the null hypothesis (H_0) is accepted. In other words, the implementation of the integrated sasambo PjBL model produces consistent outcomes in both trial classes, with no meaningful differences in the improvement of students' scientific attitudes between the two universities. These findings suggest that the integrated Sasambo PjBL model is significantly effective in consistently enhancing scientific attitudes.

Based on these results, it can be concluded that the integrated sasambo with PjBL model not only enhances students' scientific attitude skills but also maintains consistency in its implementation. This consistency testing is crucial as it provides empirical validation of the effectiveness of the integrated sasambo PjBL model within the context of scientific learning. The model offers a relevant and reliable approach to improving the quality of science education, particularly in the aspect of fostering scientific attitudes.

Conclusion

This study confirms that integrating sasambo local wisdom into the PjBL model significantly enhances students' scientific attitudes. This approach not only facilitates culturally contextual and relevant learning but also increases students' motivation and engagement through the application of local values such as cooperation and respect for

nature. With consistent results across two universities, the model has proven effective in improving scientific attitude indicators, including curious attitude, respect for facts, an open-minded attitude, perseverance, and sensitivity toward the environment. The PjBL model based on local wisdom holds great potential as an innovative strategy for developing education that balances academic achievement and character building rooted in cultural values.

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