Edubiotik : Jurnal Pendidikan, Biologi dan Terapan
ISSN 2528-679X (print), ISSN 2597-9833 (online)
Vol. 10, No. 02, November 2025, pp. 566 – 577

Available online at:
https://ejurnal.uibu.ac.id/index.php/edubiotik

Research Article

OPEN ACCESS

Student perspectives on project-based learning using local wisdom orientation on botanical learning

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Article Information

Article History:
Submitted: 2025-08-28
Revised: 2026-01-19
Accepted: 2026-01-28
Published: 2026-01-28

Keywords:
Higher education;
learning;
local wisdom;
perceived;
PjBL

ABSTRACT

Botanical education in higher education often faces challenges in contextualizing abstract plant concepts and fostering student engagement. Integrating local wisdom into botanical education through Project-Based Learning (PjBL) enhances students' learning experiences by connecting traditional ecological knowledge with scientific concepts. Brakseng, Batu Malang, provides an ideal setting for this approach, yet research on students' perceptions remains limited. This study aims to examine students' perceptions of local wisdom-integrated PjBL in botanical education by analyzing its influence on conceptual understanding, learning motivation, and perceived implementation challenges. A cross-sectional survey was conducted from August to November 2024 with 63 undergraduate biology students at Universitas Negeri Malang. Data were collected through a Likert-scale questionnaire assessing learning experience, motivation, and performance, supplemented by qualitative responses. Quantitative data were analyzed using statistical software SPSS, while qualitative data were examined through thematic analysis. Results indicate that PjBL integrated with local wisdom received a positive responses regarding student learning, motivation, and student performance skill. The majority of students agreed that project assignments improved their grasp of concepts, boosted motivation, and enhanced teamwork. Students also reported increased problem-solving abilities and engagement with environmental conservation efforts. The study confirms that PjBL incorporating local wisdom positively influences botanical education by fostering deeper learning and real-world application. These findings offer valuable insights for developing culturally responsive and sustainable educational strategies.

Publisher
Biology Education Department
Universitas Insan Budi Utomo,
Malang, Indonesia

How to Cite
Anggarani, D. A., Sari, M. S., & Sulisetijono, S. (2025). Student perspectives on project-based learning using local wisdom orientation on botanical learning. Edubiotik : Jurnal Pendidikan, Biologi Dan Terapan, 10(02), 555–567. https://doi.org/10.33503/ebio.v10i02.1441

INTRODUCTION

Botanical learning in higher education is often dominated by theoritical instruction and textbook, with limited opportunities for students to engage directly with real plant diversity and ecological contexts

(Chien et al., 2019; Prokop & Fančovičová, 2023). The results of this condition are fragmented conceptual understanding, low learning motivation, and difficulties in applying botanical knowledge to real-world environmental and sustainability issues (Zhu et al., 2024). Local wisdom in educationa curriculum has potential to develop student learning experiences by making knowledge more relevant and contextual (Wahyuni et al., 2024). Applying local wisdom approaches allows students to connect traditional ecological knowledge (Zakharova et al., 2021) with scientific concepts, fostering a deeper understanding of plant diversity, sustainable practices, and conservation efforts (Fiel'ardh et al., 2023)Click or tap here to enter text.. Brakseng, Batu Malang, is an area rich in botanical resources and traditional agricultural practices, making it an ideal site for implementing such an study approach (Kusdiyanti et al., 2024; Pramuwidia et al., 2021).

Project-Based Learning (PjBL) is widely recognized as an effective pedagogical method that enhance critical thinking, student engagement, and problem-solving skills (Kimani, 2024; Priyatni & As'ari, 2019; Singha & Singha, 2024). When combined with local wisdom approaches, PjBL provides students with experiential learning opportunities could improve academic performance as well as strengthen their motivation and engagement (Ayu Lola Monika et al., 2023; Juuti et al., 2021). By working on real-world botanical projects that incorporate traditional practices, students gain practical knowledge and develop an appreciation for indigenous environmental management techniques (Fiel'ardh et al., 2023; Zakharova et al., 2021). Therefore, integrating PjBL with local wisdom in botanical learning is an urgent pedagogical strategy to overcome the dominance of theoritical instruction in higher education and to equip students with contextual, sustainable, and applicable botanical competencies.

Despite the recognized benefits, there remains limited research on how undergraduate students perceive the implementation of PjBL with a local wisdom approach in botanical education. Understanding their perspectives is essential in evaluating the effectiveness of this educational model in enhancing learning outcomes, fostering motivation, and improving academic performance (Ngereja et al., 2020). Furthermore, insights from students can help refine curriculum design and instructional strategies to better align with their needs and aspirations (Juuti et al., 2021). This study extend to explore undergraduate students' perspectives on project-based botanical learning using local wisdom approaches in Brakseng, Batu Malang. Specifically, it seeks to analyze the impact of this educational model on student learning experiences, motivation, and academic performance. The findings are projected to contribute to the development of innovative instructional methods that leverage local knowledge to enhance botanical education in higher learning institutions.

Previous studies have documented the integration of local wisdom in educational setting, particularly in primary and secondary schools, to support character education, environmental awareness, and student engagement in science learning (Basri et al., 2024; Wulandari et al., 2023). Similarly, Project-Based Learning (PjBL) has been extensively implemented in science and biology education to enhance students' engagement, critical thingking, and problem-solving skills, mainly at the school level (Ospankulova et al., 2025; Williamson, 2023). In higher education, existing studies largerly focus on development of conceptual or pedagogical frameworks for integrating local wisdom or PjBL, with limited empirical investigation into students' lived learning experiences (Buchman, 2024). In particular, few studies have examined how undergraduate students perceive botanical learning activities that integrate local knowledge within a PjBL approach. As a result, empirical evidence describing students' perceptions, motivation, engagement, and challenges in local wisdom-oriented botanical learning at the university level remains scarce. Bridging this gap is crucial to reveal how local wisdom-based learning influences motivation, ecological awareness, and academic achievement among university students.

Moreover, incorporating local wisdom in botanical education aligns with global sustainability goals by preserving traditional knowledge and fostering an awareness of local ecological issues (Amprazis & Papadopoulou, 2024). By engaging with indigenous agricultural and botanical practices, students not only acquire technical skills but also develop a sense of responsibility toward environmental conservation and community-based resource management (Burke et al., 2022; Stroud et al., 2022). Additionally, this research highlights the potential for PjBL and local wisdom-based approaches to bridge the gap between academic learning and real-world applications. Through aunthentic project tasks rooted in local contexts, students are encouraged to apply botanical concepts to solve concrete environmental and societal problems (Beasley et al., 2023). Botanical education not only as a cognitive learning process but also as a transformative learning that supports sustainable development at both community and educational levels (Amprazis & Papadopoulou, 2025).

The experiential learning process encourages students to employ theoretical knowledge to solve hands-on issue, thereby improving their critical thinking and adaptability. This study aims to examine students' perceptions of Project Based Learning (PjBL) integrated with local wisdom in botanical education, particularly its role in enhancing understanding, motivation, and engagement, while also exploring how its approach supports sustainability-oriented learning through the preservation of local plant knowledge and the development of environmental awareness. Understanding student perspectives on this educational model can provide valuable insights for educators, policymakers, and curriculum developers in shaping more effective and culturally responsive botanical education programs.

RESEARCH METHODS

This study employed a cross-sectional survey design to describe and analyze students' perceptions of the implementation Project-Based Learning (PjBL) integrated with local wisdom in botanical education among biology and biology education students. The design enables the collection of self-reported data regarding students' perceived understanding, motivation, engagement, and perceived challenges at a single point in time, without inferring causal effects or learning outcomes. This study was conducted on November 2024 in the Department of Biology at Universitas Negeri Malang.

In this study, the researchers focused on students from the Department of Biology who were enrolled in a botany course utilizing the Project-Based Learning (PjBL) model. We targeted for a 63 participants sample size which involved in the learning implemented. The participants were undergraduate students from the Biology Education and Biology programs. They completed the survey via an online questionnaire distributed through Google Forms. The demographic characteristics of the participants are presented in Table 1.

Table 1. Participants demography

Criteria	Groups	n (N=63)	Percentage (%)
Gender	Male	49	77,8
	Female	14	22,2
Academical Background	Biology	28	44,4
	Biology Education	35	55,6
Academic Rate	High	1	2
	Moderate	35	56
	Low	28	44

Table 1 presents the demographic distribution of the participants. These data are reported solely to describe the sampel characteristics and provide contextual background for interpreting students'

perception. Given the unequal distribution across some categories, particularly academic achievement, the data were not intended for strong inferential comparisons, but rather to illustrate general trends within the sample.

Students were asked to evaluate their learning experience based on the quality of assessment in three aspects: learning, motivation, and performance. These aspects were assessed using a five-point Likert scale ranging from 1 (strongly disagree/SD) to 5 (strongly agree/SA). A total of 10 questions were used, with five items selected for each type of learning evaluation. The three categories were: 1) learning (Q1-Q4), 2) motivation (Q5-Q7), and 3) performance (Q8-Q10). Qualitative student perceptions were assessed through an open-ended question instrument. The research instrument was adapted from the study on the impact of instructional tools for PjBL in higher education by Ngereja et al. (2020). The reliability of the instrument demonstrated good internal consistency with Cronbach's alpha values of 0.847 and 0.894 across independent sample.

The research permit was approved by the Department of Biology, Universitas Negeri Malang. The collected data obtained through questionnaires stored in Google Forms. The data were downloaded in .xlsx format and then sorted by gender and age, as these two criteria play a crucical role in analyzing students' learning evaluations. Gender is closely related to and influences learning quality, while the academical background reflects students' cognitive and knowledge perceptions in this study, as well as academic rate which serves as an indicator of students' academic performance. The data were then sorted based on responses and scores using SPSS version 25. The converted scores were analyzed to determine the most frequently occurring responses, which were then expressed as percentages. These percentages illustrate students' perspectives on the learning quality of PjBL with a local wisdom orientation. The qualitative data obtained from open-ended questionnaire responses were analyze using triangulation approach based on the stages if data reduction, data display, and interpretation (Silverman, 2014). Responses were coded into thematic categories, organized into summary tables, and then compared with quantitative descriptive results to identify convergent and divergent patterns, thereby enhancing the credibility of the findings.

FINDING AND DISCUSSION

During the learning process of the Structure and Generative Development of Plants course, the implementation of Project-Based Learning (PjBL) integrated with local wisdom provides a contextual and relevant learning experience for students. This approach is designed to integrate theoretical concepts with field practice, allowing students to comprehend academic concepts through direct exploration of local potential. In its implementation, students are not only required to develop academic skills but also to enhance their collaboration, critical thinking, and creative problem-solving abilities based on local wisdom. Therefore, it is essential to identify students' perceptions of this learning model as an indicator of the effectiveness of this innovative and transformative teaching approach.

The results of students' perceptions of Project-Based Learning (PjBL) integrated with local wisdom are presented as follows. Students' perceptions of local wisdom-based PjBL are reflected in three indicators: 1) impact on students' learning, 2) motivation, and 3) performance. Quantitative findings are presented descriptively to illustrate overall perception trends, while qualitative responses from open-ended questions are used to explain, contextualize, and strengthen these quantitative results by providing insights into students' experiences and reflections during the project implementation.

Table 2 presents students' perceptions regarding the impact of project-based learning implementation. Overall, students reported positive perceptions across all indicators, with the highest

agreement observed in the facilitation of technology use, organization, and innovation (57%), followed by improved conceptual understanding (55%). These findings suggest that PjBL is particularly effective in supporting higher-order cognitive processes, as students are required to integrate digital tools and organizational skills while completing authentic tasks. In contrast, the relatively lower percentage for authentic project management experience (43%) may indicate that students are still adapting to the complexity of real-world project scenarios, especially in managing time, roles, and responsibilities independently. A similar pattern of differentiated responses across indicators was also evident in students' perceptions of local wisdom-based projects, as presented in Table 3.

Table 2. Survey results on students' perception impact on students' learning

Q	Items	SD (%)	D (%)	N (%)	A (%)	SA (%)
Q1	The task helped me develop a thorough understanding of one or more principles of project management	2	3	3	47	45
Q2	The assignment gave me the chance to deepen my comprehension of the project management concepts covered in the course	2	3	5	55	34
Q3	Through this assignment, i was able to identify three fundamental componenets of a digitalization project which are technology, organization, and innovation	2	3	7	57	31
Q4	The project assignment provided me with a real-world experience in project management.	2	3	12	43	40

SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree

Table 3 displays students' perceptions regarding the increase in motivation resulting from local wisdom-oriented project-based learning. Among the motivational indicators, project grades as a component of the final course assessment emerged as the strongest motivator (55%), indicating that extrinsic factors still play a significant role in encouraging student engagement. However, intrinsic motivation was also apparent, as reflected in students' enjoyment of collaborative teamwork (50%) and their perception of projects as meaningful learning tools (45%). This combination suggests that integrating local wisdom into projects not only enhances motivation through assessment incentives but also fosters a more engaging and socially interactive learning environment.

Table 3. Survey results on students' perception impact on motivation

Q	Item	SD (%)	D (%)	N (%)	A (%)	SA (%)
Q5	Being aware that the project assignment plays a significant role in my overall course grade encouraged me to put in additional effort	2	3	7	55	33
Q6	Understanding that my projects' outcome will serve as a learning resource in this course has driven me to work harder	2	5	12	45	36
Q7	I truly enjoyed collaborating with my teammates	2	3	9	36	50

SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree

Table 4 presents students' perceptions of the impact of local wisdom-based projects on their performance, showing relatively balanced results across all indicators. Students' confidence in their future task management abilities (45%) and in the development of project management skills through the final product (45%) indicates that the projects contributed to transferable skills beyond the classroom. Notably, the slightly higher percentage related to teamwork evaluation (47%) suggests that collaborative processes were more immediately perceived than individual performance gains, which may be attributed to the intensive group-based nature of the projects. This finding highlights the role of local wisdom-based PjBL in strengthening collaborative and reflective skills, which are essential for sustainable and community-oriented learning practices.

Table 4. Survey results on students' perceive impact on performance

Q	Item	SD (%)	D (%)	N (%)	A (%)	SA (%)
Q8	The experience i gained from working on this project assignment will enable me to manage future projects more effectively	2	3	12	38	45
Q9	I am confident that my group's final output will be a valuable educational resource for project management	2	3	10	45	40
Q10	I consider my team's performance to be exceptional, particularly in terms of collaboration, communication, and knowledge-sharing	2	3	5	43	47

SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree

In addition to descriptive quantitative analysis, qualitative data were collected to gain deeper insights into students' perceptions of the Project-Based Learning (PjBL) implementation oriented toward local wisdom. Qualitative data were obtained from open-ended questions and analyzed using a triangulation approach to complement and contextualize the quantitative findings. This analysis aimed to explore students' perceived experience, challenges, and values gained during project activities. The qualitative results from 63 student responses are presented below and interpreted in relation to the quantitative results.

Table 5. Impressions of local wisdom-based project learning in brakseng

Aspect	Items	Results
Impression	Field Learning	Majority, students felt that the field study activities provided real-world insights into the application of theoretical concepts, particularly within the local ecosystem
	Enjoyable Experiences	Nearly all respondents stated that the field study was highly engaging and enjoyable, although some experienced physical fatigue or minor technical challenges.
	Team Collaboration	Many respondents emphasized the importance of teamwork as a key factor in the project's success.
Project Making Process	Skill Development	Students developed time management, attention to detail, problem-solving, and creativity skills throughout the project-making process. Some encountered technical challenges, such as trial and error, but managed to find solutions
	The Utilization of Local Potential	The project was perceived as an opportunity to leverage local potential
	Collaboration and Adaptation	Students highlighted the significance of effective communication in resolving differences within the team
Project Finalization	Remarkable Achievement	Many students expressed satisfication with their project outcomes despite facing obstacles
	Soft Skill Training	Project finalization honed students' presentation skills, meticulous planning, and ability to convet information effectively

Through the data reduction process, the qualitative responses were summarized into recuring themes and grouped into three main categories: 1) impressions of learning activities, 2) project development process, and 3) project finalization. These themes were then compared with the quantitative perception results to identify convergent patterns in students' learning experiences. As shown in Table 5, students' qualitative impressions of field learning, enjoyment, and collaboration were consistent with the quantitative results indicating positive perceptions of learning and motivation. Students highlighted real-world exposure and teamwork as meaningful aspects of the learning process, which complementes the high levels of perceived engagement reported in the survey. Similarly, themes related to skill development, utilization of local potential, and collaborative adaptation during the project-making process

aligned with students' perceived performance outcomes in the quantitative data. In the project-making process aligned with students' perceived performance outcomes in the quantitative data. In the project finalization stage, students' satisfaction and perceived soft skill development further supported the overall trend of positive learning experiences identified through the descriptive analysis. Below are several qualitative data points derived from students' reflections on their experience:

Student 1: "The field study in Brakseng was very enjoyable because I could directly identify flowers while also strengthening solidarity among friends. The project development process was quite challenging since my group experienced trial and error, requiring us to evaluate and seek alternative solutions to ensure the project's success. The project finalization was quite satisfying, although some flowers lost their color. However, I am very pleased with the final results."

Student 2: "It was really exciting! It made learning more engaging and helped me gain a deeper understanding of flowers even though the road is difficult for vehicles to pass."

Student 3: "In my opinion, the exploration in Brakseng helped us, as students, to enhance local potential through innovations that were previously unavailable, resulting in high-quality products suitable for daily use."

Student 4: "The experience was incredibly fun and enriched my knowledge about flower cultivation in Brakseng. Additionally, the project development process trained our creativity in optimizing local resources. I hope similar activities will be conducted more frequently in the future to facilitate further learning."

Students 5: "The project is good even though it takes a long time"

Student 6: "Participating in the SPGT project, from the exploration in Brakseng to the finalization stage, was a truly memorable experience. The KKL in Brakseng provided valuable insights through hands-on learning, including resource management and local community approaches to environmental issues. The project development process itself posed unique challenges, honing teamwork, time management, and problem-solving creativity in team. The finalization stage was the culmination of our hard work, bringing immense satisfaction and pride in seeing the tangible outcomes of our team's efforts."

Student 7: "Completing the SPGT project-from the exploration in Brakseng, through the project development, to its finalization-has left a profound impression on me and provided invaluable lessons. This project offered crucial insights into applying knowledge and skills in real-life situations, teaching me to appreciate both the process and the effort required to achieve optimal results."

Although students generally reported positive perceptions of the local wisdom based PjBL implementation, qualitative findings revealed several challenges, particularly during the project development and finalization stages. Students experienced technical difficulties, trial-and-error processes that required additional time and revisions, thus difficulties of transportation access. Challenges related to the use of natural material were also noted, such as maintaining product quality. Additionally project activites demanded effective time management, coordination, and teamwork, while challenging contributed to the development of students' problem solving and collaboration skills. Project-Based Learning (PjBL) is a learning model that adheres to an inquiry-based learning method, engaging students in knowledge construction by completing meaningful projects and developing real-world products (Brundiers & Wiek, 2013; Krajcik & Shin, 2022). The principles of PjBL is align with student-centered learning, which is grounded in three constructivist principles: (1) learning is contextual, (2) students actively engage in the learning process, and (3) learning objectives are achieved through social interaction and knowledge sharing (Cocco, 2007). The implementation of projects necessitates student collaboration in identifying solutions to real-world problems by integrating, applying, and constructing knowledge (Guo

et al., 2022). Collaboration enables students to collectively explore indigenous plant knowledge (Mkhwebane, 2024; Zakharova et al., 2021) , analyze local ecological issues (Wells et al., 2021), and co-design project outcomes that reflect both scientific understanding and cultural relevance (Anggarani, Sari, et al., 2025; Sari et al., 2025). Moreover, activity-based learning approaches, such as project-based learning, empower students' perspective (Çelik, 2018) and improve future career prospects (Agustin & Apriatama, 2023; Martini et al., 2018).

In PjBL, students actively participate in the learning process, which is considered an inquiry-based approach where learning contexts are provided through authentic real-world questions and problems (Al-Balushi & Al-Aamri, 2014). The goal of PjBL is to generate new products, present outcomes, or conduct exhibitions of the created projects (Albar & Southcott, 2021). Based on the implementation of the PjBL model resulted students successfully producing at least one tangible product derived from their problem analysis in Puncak Brakseng indicating the practical realization of the learning objectives. The project development process is accompanied by collaboration, reflection, restructuring, and presentation, which are emphasized in other studies (Kwon et al., 2014). The core engagements remain relevant in contemporary PjBL practices and further operationalized through collaborative, and interactive learning process (Guo et al., 2022).

The integration of local wisdom into the project-based learning method can enhance character development, knowledge, skills, attitudes, and 21st-century competencies (Nurdiansah et al., 2021). This method encourages students to learn actively through field data exploration and analysis, which not only improves cognitive understanding but also problem-solving skills (Retnowati & Istiana, 2020) from students' perspectives, project-based learning using local wisdom as the object increases their interest in creating marketable products. Field-based learning, as a form of out-of-school learning, serves as a platform for students to develop entrepreneurial skills (Engeström & Käyhkö, 2021). Thus, this intervention can be considered a relevant strategy to enhance botanical literacy in various higher education contexts.

Local wisdom-based Project-Based Learning (PjBL) has a significant positive impact on students' learning experiences. Survey results indicate that project assignments enhance students' in-depth understanding of concepts, as reflected by the high percentage of responses in the learning category (92% for the first statement and an average of 87% in this category from the accumulated agreement and strong agreement responses). These findings align with Ngereja et al. (2020), who stated that context-based PjBL not only facilitates the connection between theory and practice but also creates meaningful learning experiences. The application of local wisdom allows students to explore regional potential while understanding sustainability values, which are relevant to 21st-century education needs (Adinugraha, 2022; Sriyati et al., 2021). This reflects that such an approach has a transformative impact on project-based learning in higher education.

Additionally, aspects of motivation and performance also show positive results, with over 80% of students feeling motivated by the project's contribution to assessment and the practical benefits of project outcomes in learning. Students also recognize that team collaboration, communication, and knowledge sharing are essential elements for project success, as evidenced by 90.5% of students rating teamwork performance highly. These findings support studies by Nurdiansah et al. (2021); Priyatni & As'ari (2019); Sari et al. (2025), which emphasize that PjBL focusing on teamwork and real-world practice integration can enhance students' critical thinking, collaboration, and innovation skills. Thus, this learning model not only improves academic comprehension but also equips students with 21st-century skills necessary for professional and social contexts.

Student reflections highlight enjoyable experiences and strengthened team solidarity, supporting previous findings by Lin (2018); Saenab et al. (2019) which suggest that project-based learning in real-world environments facilitates the development of social skills such as collaboration and effective communication. The project finalization stage also fosters a sense of pride and satisfaction, particularly as students successfully create innovative products utilizing local resources, as emphasized in student reflections (Nurdiansah et al., 2021). This indicates that project-based learning with local wisdom integration not only enhances academic understanding but also provides students with practical skills and sustainability awareness relevant to the modern era (Adinugraha, 2022; Nadya Eka Aristyasari et al., 2023).

CONCLUSION

Project-Based Learning (PjBL) integrated with local wisdom in botanical education demonstrates a generally positive contribution to students' understanding, motivation, and engagement. Although the quantitative results show moderate proportions (43-57%), consistent positive patterns across learning, motivation, and performance indicators are reinforced by qualitative evidence, which highlights increased engagement, deeper conceptual understanding, and enhanced collaboration through authentic, context-based projects. The real-world relevance of local wisdom further promotes active participation and meaningful learning experiences. Nevertheless, challenges related to time management and resource limitations were identified during project implementation. Overall, local wisdom-based PjBL holds strong potential for enhancing botanical literacy and fostering environmental sustainability awareness. To optimize its implementation, adequate institutional support and collaboration with local communities are essential. Future studies should explore the long-term effects of this approach on students' conceptual mastery and critical thinking in botany.

ACKNOWLEDGMENT

Acknowledgements are extended to the supervised lecturer, the Department of Biology Universitas Negeri Malang, expert validators, and all parties who contributed to the successful completion of this research.

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