Bioscientist: Jurnal Ilmiah Biologi
https://e-journal.undikma.ac.id/index.php/bioscientist

March 2026 Vol. 14, No. 1
e-ISSN: 2654-4571
pp. 144-152

The Use of PlantNet Identify for Identifying Arecaceae Family Plants in Biology Learning Among Biology Education Students at Universitas Labuhanbatu

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Received: January 2026; Revised: February 2026; Accepted: March 2026; Published: March 2026

Abstract: This study aimed to examine the use of the PlantNet Identify application in identifying higher plants of the Arecaceae family in biology learning among Biology Education students at Universitas Labuhanbatu. The study employed a descriptive quantitative approach, involving 21 Biology Education students selected using a total sampling technique. The data were primary data collected through an online questionnaire distributed via Google Forms, with the use of the PlantNet Identify application as the independent variable (X) and the identification of higher plants of the Arecaceae family as the dependent variable (Y). The results of the simple linear regression analysis indicated no significant relationship between the use of the PlantNet Identify application and students' ability to identify higher plants of the Arecaceae family, with a significance value of 0.357 ($p > 0.05$). The R^2 value further showed that the application contributed only 4.48% to students' identification ability. These findings indicate that there is no strong correlation between the use of PlantNet Identify and students' ability to understand plants belonging to the Arecaceae family. However, the results of this study are limited by the small sample size.
Keywords: Arecaceae; biology learning; plant identification; PlantNet identify

How to Cite*:* Simbolon, M., Khairul, & Sari, N. F. (2026). The Use of PlantNet Identify for Identifying Arecaceae Family Plants in Biology Learning Among Biology Education Students at Universitas Labuhanbatu. *Bioscientist: Jurnal Ilmiah Biologi*, *14*(1), 144–152. https://doi.org/10.33394/bioscientist.v14i1.19758

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INTRODUCTION

Indonesia is recognized as one of the world's megadiverse countries, harboring approximately 38,000 plant species, of which 55% are endemic (Simarmata et al., 2024). These species are classified into approximately 100–500 families (Teusiit et al., 2024). Among them, the Arecaceae family represents one of the most diverse plant groups in Indonesia. This family, which includes well-known species such as *Dypsis lutescens*, *Cocos nucifera*, *Elaeis guineensis*, *Areca catechu*, and *Salacca zalacca*, is not only economically important but also plays a significant ecological role (Haigh et al., 2023). Members of this family exhibit considerable morphological variation, making them particularly interesting subjects for scientific study (S et al., 2025). In addition, Arecaceae is regarded as one of the oldest lineages among flowering plants (Novianti et al., 2023).

Plant identification skills are essential for biology teachers because they are closely linked to teaching competence. Competence is an inherent and fundamental characteristic of teachers, directly associated with their professionalism (Yunita & Ulfah, 2023). These skills are important not only for understanding taxonomic concepts but also for preparing prospective educators to implement environmentally based and contextual learning for their students, given that teachers play a central role in the educational process (Sitorus & Naibaho, 2024). However, previous studies have revealed that students often have limited understanding of plant identification (Indaru, 2025). Susanti (2018) reported that 60% of 200 biology education students

experienced difficulties in understanding common plant characteristics. Bestari (2024) further emphasized that one of the factors contributing to students' difficulties in plant identification is their limited understanding of Latin terminology.

The use of the PlantNet Identify application offers one potential solution for improving students' understanding of plant identification. PlantNet Identify is an image-based plant recognition application developed by a consortium of French scientists. It enables users to identify plants simply by photographing specific morphological features (Rifa'i et al., 2020). As a crowdsourced, data-driven platform, PlantNet Identify allows users not only to identify plants but also to actively contribute to the enrichment of the global flora database. In educational settings, this application can serve as an innovative learning tool that supports inquiry-based learning and promotes exploration beyond the classroom.

Several previous studies have demonstrated the effectiveness of this application in biology learning. Mu'minah et al. (2023) showed that the use of a PlantNet Identify-assisted field trip method significantly improved student learning outcomes, with an average N-gain of 0.48 (moderate category), and received highly positive student responses (82%). A literature review by Nasution et al. (2023) also indicated that the use of digital technology-based media enhances conceptual understanding and active participation in the learning process. However, most of these studies focused on elementary or secondary school students and did not address the pedagogical dimension of preservice teachers.

Furthermore, no study has specifically evaluated the effectiveness of PlantNet Identify in improving biology education students' understanding of the Arecaceae family, despite its high morphological complexity and strong representational value for taxonomy instruction. Previous research has generally focused on elementary and junior high school students and on general learning outcomes. In addition, no study has examined the dimensions of taxonomic literacy related to morphologically complex groups such as Arecaceae among biology education students. Therefore, research is needed to strengthen technology-based taxonomic literacy in order to prepare prospective teachers who are adaptive to innovation and capable of fostering students' appreciation of nature through scientific and contextual approaches (Syamsiah et al., 2025).

This study aims to evaluate the use of the PlantNet Identify application in the process of identifying plant species, particularly members of the Arecaceae family, and its impact on improving biology education students' understanding of taxonomy. Theoretically, the findings of this study are expected to strengthen digital taxonomic literacy. Research on the use of PlantNet Identify in learning is also expected to provide pedagogical contributions by offering an alternative instructional medium that enhances students' observational and analytical skills. This approach may serve as an alternative learning strategy for improving students' observational skills, morphological analysis, and critical thinking in the context of taxonomy.

METHOD

This study employed a correlational quantitative design aimed at analyzing the role of the PlantNet Identify application in assisting Biology Education students at Labuhanbatu University in understanding the identification of higher plants in the Arecaceae family.

The study population comprised all fifth-semester students of the Biology Education Study Program at Labuhanbatu University, totaling 21 students. Because the population size was relatively small, the sample was determined using a total

sampling technique, in which all members of the population were included as research respondents. This technique was used to ensure that the data obtained comprehensively represented the population (Sugiyono, 2020).

The research data consisted of primary data collected through the online distribution of questionnaires using Google Forms. The research instrument comprised two variables: the use of the PlantNet Identify application as variable X and the ability to identify plants of the Arecaceae family as variable Y. Variable X included four aspects, namely frequency of use, feature utilization, perception of accuracy, and the usefulness of the application in plant identification, with a total of 15 statement items. Meanwhile, variable Y also consisted of 15 statement items covering aspects of morphological recognition, classification ability, ability to distinguish species, species determination, and identification procedures. All instrument items were measured using a 1–5 Likert scale, with a score of 1 indicating strongly disagree and a score of 5 indicating strongly agree.

Before being used for data collection, the research instrument was first subjected to content validity testing through expert judgment to assess the suitability of the indicators and the relevance of each statement item to the research objectives (Sakir, 2024). The instrument that had been declared valid was then tested for reliability using Cronbach's Alpha formula (Sofwatillah et al., 2024).

Data analysis was conducted descriptively to provide a general overview of the research data, including minimum value, maximum value, mean, and standard deviation (Nugroho & Haritanto, 2022). Subsequently, a normality test was performed to determine the distribution of the research data using the Shapiro–Wilk method, since the sample size was fewer than 50 respondents (Heryana, 2020).

After the assumptions for analysis were fulfilled, the data were analyzed using simple linear regression to determine the effect of PlantNet Identify application use (X) on the ability to identify plants of the Arecaceae family (Y). The regression model used was expressed in the equation $Y = a + bX$, where a is a constant and b is the regression coefficient. This analysis was intended to determine the direction and magnitude of the effect of variable X on variable Y. Significance testing was conducted at the 0.05 level; therefore, if the significance value was less than 0.05, the use of the PlantNet Identify application was considered to have a significant effect on the ability to identify plants of the Arecaceae family. In addition, the coefficient of determination (R^2) was used to indicate the extent to which variable X contributed to explaining the variation in variable Y.

RESULTS AND DISCUSSION

To ensure that the research instruments were appropriate for data collection, a reliability test was conducted for both variables. The results are presented in Table 1.

Table 1. Reliability test

Variable	*Cronbach's Alpha*	Description
X (The Use of PlantNet Identify)	0.759	Reliable
Y (Higher Plants Identification from *Arecaceae* Family)	0.708	Reliable

As shown in Table 1, the reliability test using Cronbach's Alpha produced coefficients of 0.759 for variable X and 0.708 for variable Y. These results indicate that both instruments were reliable because the obtained values exceeded the acceptable

threshold of 0.70. Therefore, the instruments were considered suitable for use in the data collection process and subsequent statistical analysis.

After confirming the reliability of the instruments, a descriptive analysis was performed to provide a general overview of the research data. The results are summarized in Table 2.

Table 2. Descriptive analysis

Aspect	Variable X	Variable Y
Mean	56.0	51.7
Standard Deviation	8.20	8.12

Table 2 shows that variable X, namely the use of PlantNet Identify, had a mean score of 56.0 with a standard deviation of 8.20. Meanwhile, variable Y, namely the ability to identify higher plants in the Arecaceae family, had a mean score of 51.7 with a standard deviation of 8.12. These standard deviation values indicate a moderate level of variation in respondents' responses and suggest that the data were relatively homogeneous. In general, the respondents' scores were fairly consistent across both variables.

Before performing inferential analysis, a normality test was carried out to determine whether the data met the assumption of normal distribution. The results of the Shapiro–Wilk test are presented in Table 3.

Table 3. Normality test

Variable	W	Sig.	Description
X	0.918	0.081	Normal
Y	0.942	0.239	Normal

As presented in Table 3, the Shapiro–Wilk normality test was used because the sample size was fewer than 50 respondents. Data are considered normally distributed when the significance value is greater than 0.05. The significance value for variable X was 0.081, while that for variable Y was 0.239. Since both values were above 0.05, it can be concluded that the data for both variables were normally distributed. Thus, the assumption of normality for regression analysis was fulfilled.

After all prerequisite assumptions had been met, a simple linear regression analysis was conducted to examine the effect of PlantNet Identify use on students' ability to identify higher plants in the Arecaceae family. The regression results are presented in Table 4.

Table 4. Simple linear regression test

Model	R	R^2	Adjusted R^2	F	df1	df2	p
1	0.212	0.448	-0.00547	0.891	1	19	0.357

Table 4 indicates that the simple linear regression analysis produced a p-value of 0.357, which is greater than 0.05. This result shows that there was no statistically significant effect of the use of PlantNet Identify on students' ability to identify higher plants in the Arecaceae family. Thus, the proposed research hypothesis was rejected.

The correlation coefficient (R = 0.212) indicates a weak positive relationship between the two variables. This means that greater use of the application tended to be associated with better plant identification ability; however, the relationship was weak and statistically insignificant. In addition, the coefficient of determination (R^2 = 0.045)

shows that the use of PlantNet Identify explained only 4.48% of the variance in students' identification ability, while the remaining 95.52% was influenced by other factors not examined in this study.

These findings suggest that PlantNet Identify did not function as a dominant determinant of plant identification ability in the present sample. One possible explanation is that the respondents were fifth-semester Biology Education students who had already been exposed to plant morphology, taxonomy, and field observation. Their identification skills were therefore likely shaped by prior academic knowledge and practical experience rather than by application use alone. In this context, PlantNet Identify appears to have functioned mainly as a supporting tool rather than as the primary source of taxonomic competence. This interpretation is consistent with broader work on botanical learning, which shows that students' understanding of plants is strongly influenced by structured botanical experience and direct engagement with plant diversity. (Colon et al., 2020).

The weak contribution of the application is also consistent with previous studies showing that digital plant-identification tools are useful, but not sufficient on their own to ensure accurate identification. In a higher-education botany course, Pernat et al. (2023) reported that students identified, on average, only about half of the plants per plot and frequently misidentified or failed to identify many species when compared with expert assessments, regardless of whether they used PlantNet or conventional identification tools. Similarly, Joly et al. (2016) described PlantNet as an image-based participatory platform designed to support non-expert users, while also noting limitations related to bias and incompleteness of the data produced by the system. These studies indicate that plant-identification applications can facilitate access to taxonomic information, but accurate identification still depends heavily on users' observational skills and botanical knowledge.

From a pedagogical perspective, the present findings should not be interpreted as evidence that PlantNet Identify has no educational value. On the contrary, several studies have shown that plant-identification apps can increase student engagement and support interest in plant learning. Finger et al. (2022) found that digital identification tools offered advantages in enjoyment and learning about plant characteristics, although paper-based keys sometimes enabled faster and more accurate identification. Chozas et al. (2023) also argued that mobile apps and citizen-science approaches can be used as educational tools to raise awareness of plant biodiversity among students and the wider public. In the same direction, Canuto (2023) found that pre-service teachers perceived plant-identification apps as engaging, helpful, easy to use, and supportive of scientific literacy. Therefore, the educational contribution of PlantNet Identify may be more motivational and supportive than directly determinative of identification performance.

Another important consideration is that the effectiveness of image-based plant-identification apps may depend on the quality of the photographs and the plant organs captured. Hart et al. (2023) emphasized that the accuracy of free automated plant-identification applications in real-world field conditions varies depending on the circumstances in which they are used. This helps explain why the contribution of PlantNet Identify in the current study was limited. If students did not photograph diagnostic features clearly, or if identification relied on incomplete visual information, the application's recommendations may not have been sufficiently accurate to produce a measurable improvement in identification ability.

Technical and contextual barriers may also have reduced the impact of the application. Canuto (2023) identified weak internet connection as a primary issue

affecting the use of plant-identification apps, while Bawingan et al. (2024) reported that users generally found such apps interesting and useful but still experienced problems such as slow internet connection and inconsistencies in identification results. These obstacles may reduce the practical effectiveness of the application during learning activities, especially in settings where users depend on stable connectivity and accurate image processing. Thus, even if students perceive the app positively, those limitations may weaken its observable statistical effect on learning outcomes.

The comparison with previous studies further highlights this point. Some studies have shown that PlantNet Identify can be effective when used as part of a structured learning strategy. For example, Pujianto et al. (2020) reported that students taught with PlantNet Identify achieved higher scores than those taught through conventional classroom discussion across visual, auditory, and kinesthetic learning styles. This suggests that the app may be more effective when integrated deliberately into instructional design than when treated simply as an independent predictor of identification ability.

To illustrate this comparison, the findings from Pujianto et al. (2020) are presented in Table 5.

Table 5. Comparison of PlantNet Identify and conventional classroom discussion

Learning Style	Score (*PlanNet Identify)*	Score (Class Discussion)
Visual	98.214	76.410
Auditory	98.889	79.717
Kinesthetic	97.706	77.438

As shown in Table 5, students who learned using PlantNet Identify obtained higher scores than those who learned through conventional classroom discussion across all three learning styles. These results imply that PlantNet Identify has potential as a learning medium that can accommodate different student preferences. However, in the present study, the application explained only a small proportion of the variance in students' plant identification ability. This difference may be due to contextual factors, including differences in participant characteristics, prior knowledge, learning objectives, and the way the application was integrated into the learning process.

In addition, the relatively small sample size in this study (n = 21) should also be considered when interpreting the results. A small sample may reduce statistical power and make it more difficult to detect weak effects. Therefore, the non-significant finding may reflect both the genuinely limited contribution of the application and the limited sensitivity of the analysis to identify small educational effects.

Overall, the findings of this study indicate that the use of PlantNet Identify was not significantly associated with improved ability to identify higher plants in the Arecaceae family among Biology Education students at Universitas Labuhanbatu. Nevertheless, the application still appears to have value as a complementary learning resource. Its main strengths may lie in increasing accessibility, supporting preliminary recognition, and encouraging students' interest in plant learning, whereas deeper identification competence still depends on prior botanical knowledge, field experience, and careful observation of morphological characters. Future research should therefore involve larger samples and examine additional variables, such as prior knowledge, learning motivation, field practice intensity, and the quality of plant photographs used during identification.

CONCLUSION

This study found that the use of PlantNet Identify did not have a statistically significant effect on the ability of Biology Education students at Universitas Labuhanbatu to identify higher plants in the Arecaceae family. Although a weak positive relationship was observed, the contribution of the application to students' identification ability was minimal. These findings suggest that plant identification skills were influenced more strongly by other factors, particularly prior knowledge, field experience, and botanical understanding.

Nevertheless, PlantNet Identify remains potentially useful as a complementary learning tool. Its main contribution appears to lie in supporting preliminary identification, facilitating access to plant information, and enhancing student engagement in botanical learning. Future studies should include larger samples and additional explanatory variables to better clarify the factors influencing students' plant identification ability.

RECOMMENDATION

This study is limited by its relatively small sample size, requiring caution in interpreting its results. These results cannot necessarily be generalized to a larger population. Future research is recommended to test the use of the PlantNet Identify application for identifying higher plants in the *Arecaceae* family with a larger and more heterogeneous sample to obtain more representative results.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to all parties who contributed to this study, especially the respondents who participated in the research and those who provided support during the research process.

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