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Uncovering the local potential of the islands: Development of a reference book on popular plants of north Maluku with high economic value as teaching material for basic biology courses

Ade Haerullah[1*], Said Hasan[1], Suparman[1], Arini Z Nasichah[1], Iswadi M. Ahmad[2]
[1]Department of Biology Education, Khairun University, Indonesia; haerullah.bio.unk@gmail.com (A.H.).
[2]Universitas Nahdatul Ulama Maluku Utara, Indonesia.

Abstract: The rich biodiversity of the North Maluku Islands, particularly its economically valuable plant species, remains underutilized as educational material in biology instruction. This study aims to develop a reference book featuring popular economically significant plants of the North Maluku Islands for use in introductory biology courses. Employing a research and development (R&D) approach, the study integrates surveys and the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). The survey involved interviews with 300 local residents, field observations, and literature reviews to identify popular plants and their economic and biological characteristics. Key species identified include nutmeg (*Myristica fragrans*), clove (*Syzygium aromaticum*), kenari (*Canarium indicum*), coconut (*Cocos nucifera*), sago (*Metroxylon* sp.), and durian (*Durio zibethinus*). The reference book was developed based on these findings and validated by subject-matter experts and media specialists. Results from the limited trial involving biology students at Khairun University indicated high levels of validity, practicality, and effectiveness. The contextually rich and locally grounded content of the book significantly enhanced students' comprehension of core biological concepts, demonstrating the value of integrating local natural resources into higher education biology curricula.

Keywords: *Biology education, Contextual learning, Economically valuable plants, Local biodiversity, North maluku islands, Reference book.*

1. Introduction

Indonesia is an archipelagic country located in the tropical region between the continents of Asia and Australia, with geographical and climatic conditions that are highly conducive to high levels of biodiversity. This uniqueness makes Indonesia one of the world's megadiverse countries, with a wealth of flora and fauna spread across various regions, including North Maluku Province. This region consists of 805 islands, characterized by an archipelagic landscape, relatively narrow landmasses, and extensive marine areas, making North Maluku a strategically important area with abundant natural resources, both on land and at sea [1, 2].

Biodiversity in North Maluku is very high, especially in plant species that have important economic and cultural value. Many of these plant species have been traditionally utilized by local communities and hold great potential for development in various aspects of life, including education. In an educational context, these local plants can serve as contextual and meaningful learning resources, particularly in introductory biology courses that require real-world examples to reinforce understanding of biological concepts such as adaptation, ecology, evolution, and biodiversity.

However, the reality on the ground shows that the high economic value of local plant resources has not been optimally utilized in education, particularly in the development of teaching materials and learning media. The available basic biology learning materials tend to be general in nature, less relevant

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* Correspondence: haerullah.bio.unk@gmail.com

to the local context, and fail to highlight the potential of the natural resources surrounding the students. This results in low appreciation among students for local resources and limited understanding of the sustainable utilization of local plants.

Previous studies have highlighted the diversity of plants and ethnobotany in North Maluku, such as those conducted by Wijaya and Dewi [3], Disi [4], Mirmanto [5] and Hendaru, et al. [6]. These studies have made important contributions to documenting local plant species, but few have integrated these findings into formal learning resources. Additionally, there is a lack of comprehensive reference books that present information about economically valuable plants in North Maluku in a format suitable for introductory biology courses at the university level.

In fact, the development of locally-based teaching materials has proven to be effective in improving learning outcomes. Adillah [7], Rahma, et al. [8] and Habiba, et al. [9] demonstrate that teaching materials incorporating real-life illustrations from the learners' environment can enhance learning interest, conceptual understanding, and promote active and contextual learning. On the other hand, Haerullah and Hadi [10], Haerullah, et al. [11], Haerullah, et al. [12], Haerullah, et al. [13] and Haerullah, et al. [14] also emphasize the importance of learning innovation by utilizing local resources as a strategy to increase student engagement and foster awareness of environmental conservation.

In this context, the development of a reference book based on economically valuable popular plants in North Maluku is highly relevant. This book not only serves as an educational tool to enrich the content of Basic Biology, but also as a means to foster ecological awareness and appreciation for local biodiversity. Additionally, the book can act as a bridge between traditional knowledge passed down orally by local communities and modern scientific knowledge, as well as an effort to preserve traditional knowledge that has been transmitted orally for generations.

Thus, this study aims to develop a reference book based on the local potential of popular plants in North Maluku that have high economic value, which can be used as teaching material in Basic Biology courses. The development of this book was carried out through a survey approach and Research and Development (R&D) methods based on the ADDIE model, as well as validation by experts and limited testing on students. It is hoped that this reference book will make a tangible contribution to improving the quality of education, particularly in introducing basic biological concepts directly related to the local context of the students.

2. Literature Review

Local biodiversity has great potential to be integrated into the learning process, particularly in biology subjects and courses. Various studies have shown that the use of local resources in learning can improve the effectiveness of the learning process, provide contextual experiences to students, and foster ecological awareness and love for the surrounding environment. In the context of North Maluku, the wealth of local flora with high economic value has not yet been fully utilized as a systematic and structured learning resource.

Previous studies have provided a strong foundation for the importance of developing teaching materials based on local potential. Adillah [7], Rahma, et al. [8] and Habiba, et al. [9] show that teaching materials developed based on local biodiversity can improve student learning outcomes and motivation. Reference books or teaching materials designed with local conditions in mind are proven to be easier for students to understand because they are relevant to their environment and daily experiences.

Research conducted by Haerullah and Hadi [10] highlights the low utilization of local natural resources in the development of learning media. Teachers and lecturers tend to still rely on conventional media such as blackboards and posters, without integrating local natural resources as learning resources. However, according to Haerullah and Hadi [10] professional educators should be able to create innovations in learning, especially by utilizing local potential as authentic and meaningful educational media.

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Several ethnobotanical studies have also documented the rich plant diversity in North Maluku, which holds significant economic and cultural value. Wijaya and Dewi [3] investigated the types of medicinal plants used by communities in pre- and postnatal care. Disi [4] explored the use of poisonous plants, while Mirmanto [5] compiled the composition of flora and the structure of natural forests on Ternate Island. Hendaru, et al. [6] identified the morphological characteristics of local bananas from North Maluku. However, these findings have not been widely utilized directly in the development of formal educational materials at the university level.

In addition, the results of Haerullah, et al. [12], Haerullah, et al. [13] and Haerullah, et al. [14] emphasize the importance of a learning approach based on local needs and wisdom. They show that local potential-based biology learning can build 21st-century skills in students in multi-ethnic environments. This context is very relevant for North Maluku, which has a unique cultural diversity and natural resources.

Meanwhile, reference books as a form of teaching material have their own advantages. According to Habiba, et al. [9] reference books that are equipped with colorful images and local information are able to attract students' interest and increase the effectiveness of learning. The flexibility of their use also allows students to learn independently and adjust to their own pace. This is in line with Nadya [15] findings, which emphasize the importance of utilizing local information in ethnobiology lectures.

However, there is a gap between the wealth of information that has been gathered in various studies and the need for systematic, applicable, and contextually relevant teaching materials. Information about economically valuable local plants in North Maluku is still fragmentary and has not been compiled into a reference book that can be used directly in basic biology education.

Therefore, the development of a reference book that presents information on popular plants in North Maluku with high economic value is an urgent need. This book will not only be a learning resource that strengthens understanding of biological concepts, but also play a role in the conservation of local knowledge and the empowerment of students as part of a community that cares about the sustainability of biological resources.

3. Materials and Methods

This study uses a mixed methods approach that combines survey and development methods (Research and Development). This approach was chosen to gain an in-depth understanding of the types of local plants with high economic value in North Maluku, as well as to develop teaching materials in the form of reference books relevant to the local context of Basic Biology learning. The development model used is based on the ADDIE approach (Analysis, Design, Development, Implementation, Evaluation), which provides a systematic framework for designing, testing, and refining field-based learning products.

The subjects in this study consisted of three main groups. First, 300 local people in 10 districts/cities in North Maluku Province were selected as survey respondents. They were chosen based on their knowledge and experience in cultivating and utilizing plants with high economic value. Second, five biology experts and five educational media experts were involved in the validation process of the reference book developed, to assess the scientific aspects and suitability of the media. Third, 30 students from the Biology Education Program at Khairun University who were taking the Basic Biology II course participated in a limited trial to obtain feedback from direct users on the effectiveness and suitability of the product.

Data collection was conducted using several techniques, namely structured interviews with the community to identify popular plants and their uses, field observations to verify the existence and actual condition of these plants, documentation to record visual data and descriptive information, and questionnaires to measure student responses to the book. Additionally, validation forms were used by experts to evaluate the quality of the content, media design, and pedagogical aspects of the reference book.

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The development process was carried out in seven stages in accordance with R&D principles adapted to the ADDIE model. The first stage was the collection of initial information through surveys and literature studies. The second stage was planning to design the content structure and visual design of the book. The third stage was the preparation and development of the initial product in the form of a draft reference book. Fourth, the book is tested on a limited scale with students. Fifth, the product is revised based on the results of the small-scale testing. Sixth, the book is tested again through limited testing with students who match the target audience. Seventh, final revisions are made based on expert validation and student feedback to ensure the product meets the standards of quality.

The data obtained were analyzed descriptively and quantitatively. Expert assessments of product quality were analyzed using a Likert scale and converted into percentages, with five criteria for suitability: highly suitable (81–100%), suitable (61–80%), fairly suitable (41–60%), less suitable (21–40%), and unsuitable (0–20%). To assess students' responses to the reference book, a percentage formula was used based on the actual score divided by the maximum score, multiplied by one hundred percent. This analysis provides a quantitative overview of the extent to which the developed reference book is considered relevant, interesting, and beneficial in supporting the learning process of Basic Biology based on local potential.

Data from the validation sheets collected were analyzed descriptively using a Likert scale. The percentage of assessment results were converted into product feasibility categories according to the criteria in Table 1.

Table 1.
Percentage of Validity Qualifications.

Achievement Level (%)	Qualifications	Description
81 – 100	Very appropriate	No revision needed
61 – 80	Appropriate	No revision needed
41 – 60	Sufficiently appropriate	Revised
21 – 40	Insufficiently appropriate	Revised
0 – 20	Very insufficiently appropriate	Revised

4. Results and Discussion

The results of this study are divided into two main sections: the results of a survey of local communities in North Maluku regarding their perceptions and utilization of popular plants with high economic value, and the results of the development and testing of a reference book designed as teaching material for the Basic Biology course. The survey conducted on 300 respondents in 10 districts/cities revealed that there are more than 30 types of plants known to have economic value. However, the six most popular and widely cultivated plants are nutmeg (*Myristica fragrans*), cloves (*Syzygium aromaticum*), kenari (*Canarium indicum*), coconut (*Cocos nucifera*), sago (*Metroxylon sp.*), and durian (*Durio zibethinus*). The high popularity of these plants is influenced by several key factors, including high economic value, ease of cultivation, high levels of consumption, and health benefits. 88.6% of respondents stated that high market value was the main reason they chose and cultivated these plants, while 75.2% cited consumption as an important consideration. These findings align with previous research indicating that economic value and community consumption patterns are dominant factors in the conservation and utilization of local plants.

The survey results also show that public perceptions of these plants are influenced by a number of factors, as shown in Figure 1.

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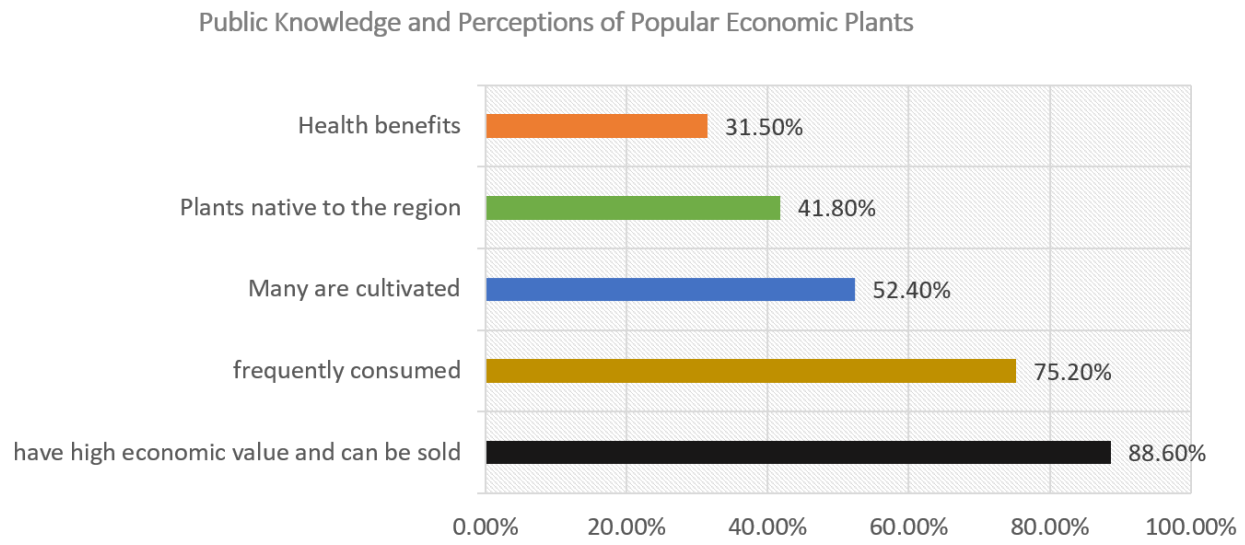

Figure 1.
Community Knowledge and Perceptions of Popular Economic Plants.

The results of this study indicate that public perception of popular plants in North Maluku is influenced by multiple interrelated factors. Economic factors and ease of cultivation are the main drivers, as they directly contribute to farmers' income and the sustainability of farming businesses. This aligns with the findings of Ahmad [16] and Habsyi, et al. [17] that "economic value is a determining factor in the development of local plants."

Consumption factors and health benefits also reinforce the position of plants in community life, indicating that cultural and health aspects are equally important. This is consistent with the findings of Hakim [18], Ahmad [16] and Ahmad, et al. [19] which state that "consumption preferences and health benefits are the primary determinants of the sustainability of traditional plant use."

Furthermore, the survey results indicate that these popular plants have diverse functions in people's lives. A total of 92.6% of respondents use the plants for personal consumption, while 81.8% sell them in markets as economic commodities, and 58.8% use parts of the plants as materials for handicrafts, construction, or traditional medicine. These findings confirm that the utilization of local plants is not limited to economic aspects but also reflects local wisdom in maintaining a balance between utilization and conservation. This provides a strong foundation for integrating these plants into biology curricula that not only teach theoretical concepts but are also socially and culturally relevant.

These findings show that popular plants have multiple functions in people's lives, ranging from personal consumption to commercial and traditional uses. Details of these results can be seen in Figure 2.

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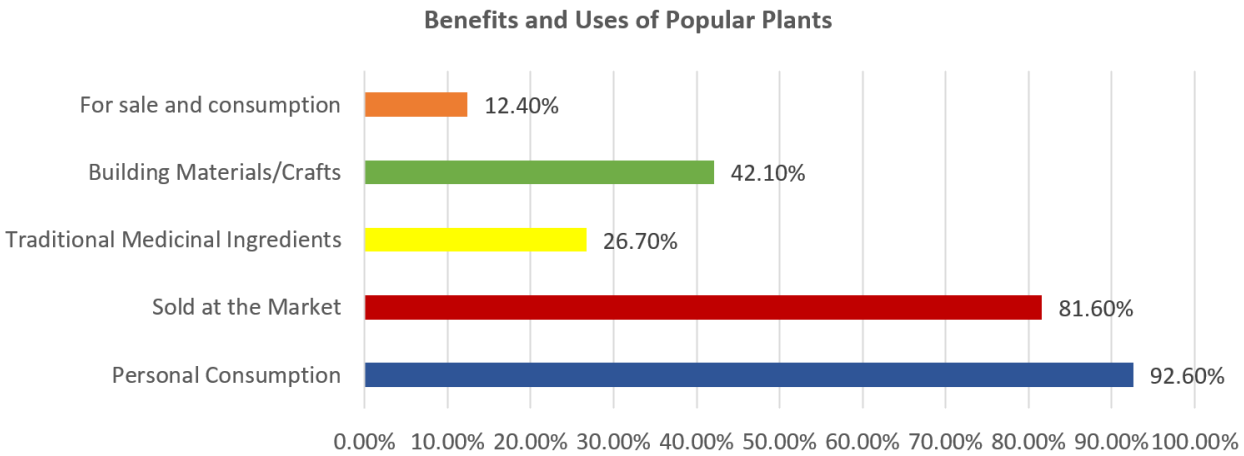

Figure 2.
Benefits and Uses of Popular Plants.

The results of this study are consistent with Ahmad [16] and Habsyi, et al. [17] that the utilization of local plants for personal consumption strengthens food security and increases community dependence on local natural resources. These findings are also consistent with research by Ahmad, et al. [19] which states that "the utilization of plants as market commodities improves the economic status of communities. In addition to direct benefits as food and market commodities, popular plants are also utilized as craft materials, building materials, and traditional medicines by 58.8% of the community. The use of plants as craft materials and building materials demonstrates the economic and cultural diversity of these plants. According to Ahmad [16] the diversity of uses for locally distinctive plants is crucial in preserving cultural identity while boosting the local economy through innovations in products based on local plants.

The results of the reference book development process show excellent quality based on expert validation. The validation was carried out by five biology experts and five learning media experts, with very satisfactory results. The material aspect received an average score of 92%, indicating that the content of the book is considered accurate, relevant, and in accordance with biology learning standards. The media aspect received a score of 89%, indicating that the visual presentation and graphic elements of the book are considered attractive and supportive of the learning process. Meanwhile, the learning aspect received the highest score of 93%, indicating that the book is considered highly effective in supporting learning objectives. This validation reinforces findings from previous studies emphasizing the importance of contextual and engaging educational media in enhancing students' interest and understanding. The details of the validation results are shown in Figure 3.

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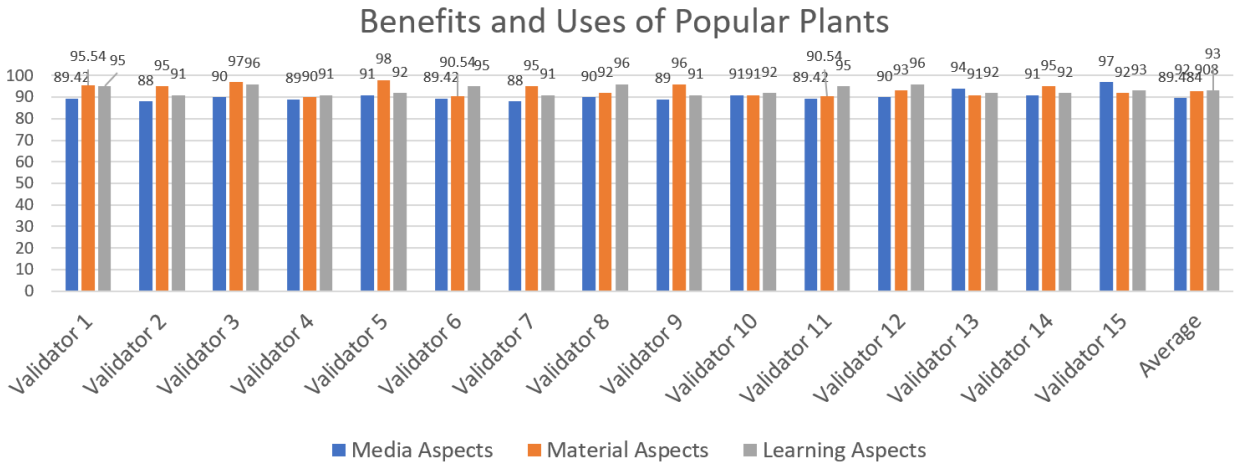

Figure 3.
Graph of Validation Results for Reference Book on Popular Plants with High Economic Value.

A limited trial conducted on 30 students of the Biology Education Study Program at Khairun University showed very positive results. Students responded highly to the reference book developed, with an overall average score of 90.76%. In more detail, the aspect of relevance of the material to students' experiences received a score of 90.84%, the aspect of media appeal scored 88.66%, and the aspect of learning benefits achieved 92.78%. These findings indicate that students not only feel assisted in understanding basic biological concepts but also feel more connected to the material because the book highlights real-life examples from their surrounding environment. This positive response reinforces the view that learning based on local potential can enhance cognitive and affective engagement among learners.

This finding is in line with the results of a study Husna and Supriyadi [20] which states that the use of appropriate media can increase student motivation and understanding. Furthermore, for the overall learning aspect, the score was 93%, meaning that this book is highly suitable as teaching material because it effectively and efficiently supports the teaching and learning process, particularly in basic biology education. These results indicate that the reference book on popular plants of North Maluku, which has high economic value, has met the criteria for very good quality and is suitable for use as teaching material in educational settings. Its success in meeting these validation standards confirms that the book is not only informative and scientifically accurate but also visually appealing and capable of supporting effective learning processes. Thus, the book on popular plants of North Maluku with high economic value can play a significant role in enhancing students' understanding of the region's economically valuable biological diversity.

The results of the data analysis show that students responded very positively to the reference book, with an average score of 90.76% in terms of material relevance, media appeal, and learning benefits. Details of student responses are shown in Figure 4.

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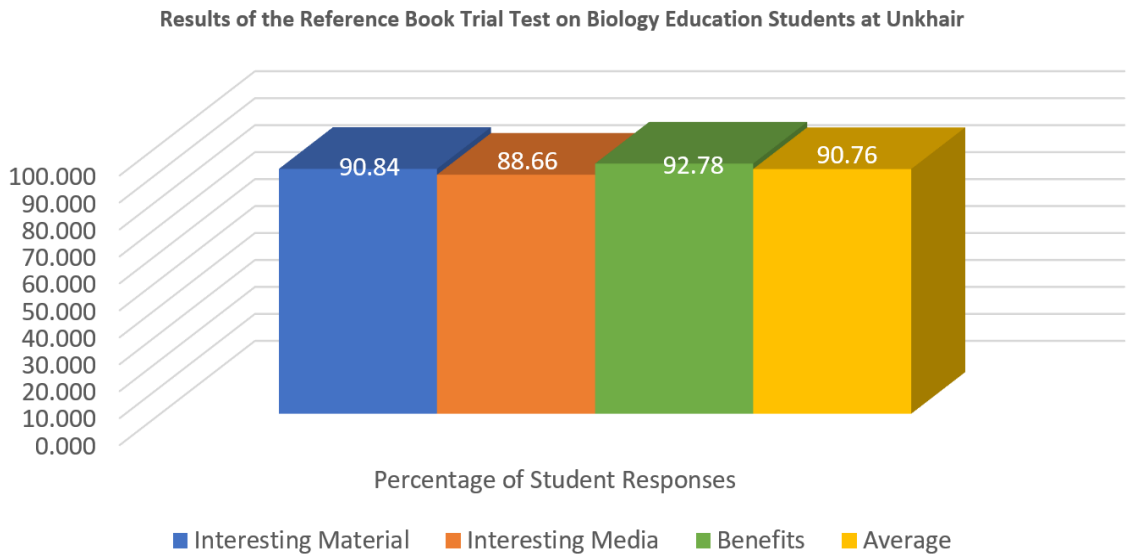

Figure 4.
Students' Responses to Reference Books on Popular Plants with High Economic Value.

Overall, the results of this study indicate that popular reference books on plants in North Maluku have high economic value and can be effective learning media in higher education, particularly in basic biology courses. The integration of local potential in learning not only improves students' conceptual understanding but also fosters an appreciative attitude toward natural resources and local wisdom. Therefore, this model of instructional material development can be adopted as an innovative strategy for strengthening a curriculum that is contextual, adaptive, and oriented toward the development of character and 21st-century competencies.

This finding is consistent with the research [21] stating that the use of biology reference books can improve students' understanding of biology material and increase their interest and motivation to learn. Thus, the evaluation results indicate that the reference book has excellent quality and is suitable for use as an effective learning medium to enhance students' understanding of local plant diversity and its benefits, which ultimately strengthens the learning of basic biological concepts and increases appreciation for the region's biological richness.

5. Conclusions

Based on the results of the research conducted, it can be concluded that the development of a reference book on popular plants with high economic value from the North Maluku Islands region contributes significantly to improving the quality of basic biology education in higher education. A survey involving 300 local residents successfully identified more than 30 economically valuable plant species, with six main species—nutmeg, cloves, cashews, coconuts, sago, and durians—being the most widely recognized and utilized. Economic factors, consumption habits, and the usefulness of the plants were the primary drivers for the selection and conservation of these plants by the community.

The reference book developed using the ADDIE model approach has been proven to be valid, practical, and effective. Validation results by experts show that the product has a very high level of feasibility in terms of content, media design, and support for the learning process. A limited pilot test involving students from the Biology Education Program also yielded very positive responses, with students finding the book relevant to their local context and helpful in enhancing their understanding of basic biological concepts. These findings reinforce the importance of locally-based learning innovations

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as a strategy to enhance student engagement, foster ecological awareness, and enrich their understanding of the biological diversity of their home regions.

Thus, this reference book not only serves as a learning support medium, but also as a form of integration between science and local wisdom. The development of similar teaching materials is highly recommended in other regions with rich biodiversity in order to strengthen contextual, relevant, and sustainable education.

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Transparency:
The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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