



Identifying and Utilizing Local Potentials in Rubiah Island as a Biology Learning Resource

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Abstract: This research focuses on exploring the various benefits of integrating local potential into biology learning to enhance conceptual understanding, student engagement, improve thinking skills, change behavior, and environmental awareness. The aim of this study is to provide a comprehensive analysis of how the potential of local biodiversity in coral reef ecosystems can be effectively integrated into biology learning. The method used was an exploratory descriptive study. The research was conducted on Rubiah Island. Data collection techniques included direct observation and literature review. The data obtained were then analyzed using data reduction, data presentation, and conclusion drawing techniques. The results indicate that local potential coral reefs can be utilized as learning resources through their utilization. They do not require special design and can be directly applied and used in the learning process. Integrating local potential into biology learning offers promising opportunities for innovative and engaging learning experiences. The material related to this utilization is biodiversity, including species diversity, the benefits and value of biodiversity, the classification of living things, animals, ecology, and environmental change. The conclusion of this study indicates that the utilization of local potential can enrich the reference sources for biology learning while providing a positive impact on environmental sustainability.

Keywords: Biology; Learning resource; Local potential; Rubiah Island

Introduction

The United Nations (UN) declared that the Sustainable Development Goals (SDGs) are an urgent call for all developed and developing countries to act globally to end poverty and other deprivation, improve health and education, reduce inequality, and spur economic growth, while addressing climate change and conserving oceans and forests. This is also beginning to have an impact in Indonesia, where education is one sector that can solve this problem. Specifically, through achieving SDG 4 (Quality Education) and promoting environmental conservation actions as mandated in

SDG 14 (Life Below Water). One effort to foster a good understanding of the environment can be realized through utilizing local potential as a learning resource (Kelialat et al., 2025; Khairani et al., 2023).

Many studies have explored various uses of local potential for biology education, including on mangrove ecosystems (Fitriyani et al., 2021), biodiversity (Nusantari & Lihawa, 2017; Slamet et al., 2020), regional flora and fauna (Ismiati, 2020), local fruits and vegetables (Komarayanti et al., 2019), integration of local potential in topics such as ecosystems, biodiversity, and plant structure (Imtihana & Djukri, 2020), and integration of local coffee plant potential in the

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development of biology teaching modules (Rosalvin et al., 2022).

The integration of local potential in biology education creates contextual learning and connects students to real life, improving skills and literacy, scientific processes, generic abilities, critical thinking, and scientific attitudes (Imtihana & Djukri, 2020). Utilizing local potential in the learning process also provides educators with the opportunity to create more meaningful learning experiences and foster improve environmental awareness among students (Fitriyani et al., 2021; Ismiati, 2020). Furthermore, the integration of local potential in science learning also improve 21st-century skills, including learning outcomes, conceptual understanding, critical thinking skills, problem-solving skills, environmental literacy, and students' love care of local culture (Kamila et al., 2024).

Theoretically, the utilization of local potential is closely related to the theory of meaningful learning that connects new knowledge with familiar concepts, thus making it more stable and sustainable (Hafidzoh et al., 2023; Purwati, 2023; Rahmah, 2013). Furthermore, the integration of local potential is also in line with place-based education, which explicitly uses the surrounding environment as a living laboratory (Marliana & Noor Hikmah, 2013; Trisnawaty, 2016), while also strengthening students' cultural identity and local connections (Azhary et al., 2025).

Recent research highlights the importance of integrating local potential into the learning process. Researchers have shown that developing teaching materials and learning activities based on local potential in the form of environmental, cultural, and technological resources unique to a particular region has been proven to contextualize learning and increase student engagement (Purwasih & Wilujeng, 2023; Wilujeng et al., 2024), and has the potential to increase student understanding and enthusiasm in learning (Sriyati et al., 2023). In addition, the development and implementation of learning models, learning approaches, teaching materials, learning media, and management of science learning curricula based on local potential can have a positive influence on the teaching and learning process (Putri & Artanto, 2025). Other reports also show that LKPD based on local potential is practical in improving students' critical and creative thinking skills simultaneously (Novian et al., 2025).

Based on these findings, students and educators can directly experience various benefits when integrating local potential into the learning process. This advantage has certainly encouraged many researchers to delve deeper into the local potential found in their respective regions and project it into various scientific fields. The urgency of this research arises from the fact that there is still a lack of structured teaching materials that map

specific biological resources in vulnerable areas, such as the Rubiah Island Coral Reef, which is a vital ecological asset that requires conservation awareness, despite strong recommendations for integrating local potential encourage from the government. Therefore, this study aims to fill this gap and provide a roadmap for educators, namely mapping the integration of local biological resource potential in the Rubiah Island Coral Reef Area as a source for learning biology, in order to realize meaningful, contextual, and sustainable learning.

Method

The method used in this study is an exploratory descriptive approach to analyze the local potential of biodiversity on Rubiah Island as a learning resource for biology education. Data collection techniques were carried out through direct observation and literature studies. Observations were used to find the local potential of biodiversity in the Coral Reef Ecosystem, and then literature studies aimed to analyze this local potential as a learning resource. Data obtained from observations and interviews were analyzed using data reduction, data presentation, and conclusion drawing techniques (Miles & Huberman, 1994). This study provides a comprehensive analysis of how the local potential of Rubiah Island, especially biodiversity in the coral reef ecosystem, can be effectively integrated into biology learning (Figure 1).

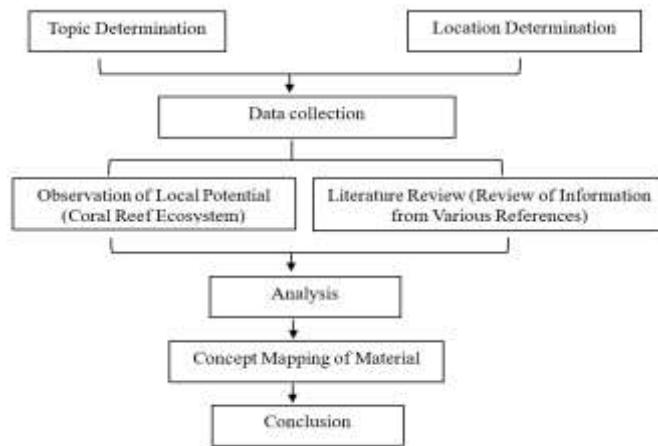


Figure 1. Research Flow

Result and Discussion

Identifying Local Potentials in Rubiah Island as a Biology Learning Resource

This research was conducted on the coral reef ecosystem of Rubiah Island, an area renowned for its beauty and diversity of aquatic life on Sabang Island. The research began with direct observation to assess the diversity of coral reef biota, followed by identification

and literature review to support the findings. The findings are outlined below.

Table 1. Coral Species Found on Rubiah Island

Other Name	Familia	Latin Name
Karang Kembang Kol	Pocilloporidae	<i>Pocillopora</i> sp.
Karang Daun	Merulinidae	<i>Echinopora</i> sp.
Karang Batu	Merulinidae	<i>Goniastrea</i> sp.
Karang Trumpet / Tongkat Permen	Merulinidae	<i>Caulastraea</i> sp.
Karang Senja	Agariciidae	<i>Coeloseris</i> sp.
Karang Otak	Lobophylliidae	<i>Lobophyllia</i> sp.
Karang Meja / Tanduk Rusa	Acroporidae	<i>Acropora</i> sp.
Anemon Laut	Enthemonae	<i>Stichodactyla</i> sp.
Karang Api	Milleporidae	<i>Millepora</i> sp.
Karang Gelembung	Plerogyridae	<i>Plerogyra</i> sp.
Karang Matahari	Dendrophylliidae	<i>Tubastrea</i> sp.

Based on the findings, 11 corals species from 9 different families were identified. Some are thriving, while others are damaged. However, conservation efforts are ongoing by the local community to improve the situation. This evidenced by the conservation area around Rubiah Island managed by the Lembaga Adat Laot system (Aswita et al., 2017; Hastuty et al., 2014). Several species of reef fish have also been found at this location, which are presented in the table 2.

Based on the analysis, it can be seen there are 32 fish species from 20 families found in coral reef ecosystems. This diversity of fish species provides unique characteristics and quite potential to be used as a biology learning resource. These studies emphasize the importance of utilizing local biodiversity as a learning resource, as it can provide students with direct experience and enhance their understanding of biological concepts while fostering an appreciation for the surrounding ecosystem. Some of these studies include research on the use of freshwater fish diversity for the development of picture cards (Efendi et al., 2022), the use of marine fish diversity for use in educational booklets (Sari et al., 2021), and species diversity as a learning resource for high school biology (Faturrahman et al., 2024).

Local potential is a powerful contextual learning resource that can transform biology education by connecting students directly with their environmental context. Andarias et al. (2022) identified six local plant species suitable for biology learning at the junior and senior high school levels, particularly for topics classification and biodiversity. Nurmala et al. (2019) also identified seven flower species that can be used as local learning resources, highlighting the diversity of potential educational materials.

Local potential offers significant pedagogical advantages, helping students to overcome learning

fatigue, providing diverse learning experiences, and enabling direct engagement with the environment. Ramadhani et al. (2024) further emphasize that utilizing local biodiversity can support character education and internalize important values.

Table 2. Types of Reef Fish Found on Rubiah Island

Other Name	Familia	Latin Name
Ikan Sersan Mayor	Pomacentridae	<i>Abudefduf vaigiensis</i>
Ikan Dakocan Putih	Pomacentridae	<i>Dascyllus carneus</i>
Ikan Badut Clark	Pomacentridae	<i>Amphiprion clarkii</i>
Ikan Nemo	Pomacentridae	<i>Amphiprion ocellaris</i>
Ikan Giru	Pomacentridae	<i>Amphiprion perideraion</i>
Ikan Injet	Pomacanthidae	<i>Pomacanthus imperator</i>
Ikan Piso Piso	Centriscidae	<i>Aeoliscus strigatus</i>
Ikan Pogot Bintang	Balistidae	<i>Odonus niger</i>
Ikan Elak / Ikan Beberas	Kyphosidae	<i>Kyphosus bigibbus</i>
Ikan Bermuda Chup Kuning	Kyphosidae	<i>Kyphosus sectatrix</i>
Ikan Kakak Tua	Scaridae	<i>Chlorurus spilurus</i>
Ikan Kakak Tua Berkarat	Labridae	<i>Scarus ferrugineus</i>
Ikan Kurisi	Nemipteridae	<i>Scolopsis lineata</i>
Ikan Kurisi Sirip Benang	Nemipteridae	<i>Scolopsis bilineata</i>
Ikan Botana	Acanthuridae	<i>Acanthurus maculiceps</i>
Ikan Jerawat	Acanthuridae	<i>Acanthurus lineatus</i>
Ikan Botana Kasur	Acanthuridae	
Ikan Dori	Acanthuridae	<i>Paracanthurus hepatus</i>
Ikan Moris	Acanthuridae	<i>Zanclus cornutus</i>
Ikan Burung Laut	Acanthuridae	<i>Zebrasoma scopas</i>
Ikan Julung-Julung	Belonidae	<i>Platybelone argalus</i>
Ikan Pogo-Pogo	Balistidae	<i>Balistoides viridescens</i>
Besar		
Ikan Kepe Tikar	Chaetodontidae	<i>Chaetodon vagabundus</i>
Ikan Kepe	Chaetodontidae	<i>Forcipiger longirostris</i>
Monyong		
Ikan Kepe Gajah	Chaetodontidae	<i>Chaetodon lunula</i>
Ikan Marbahan	Pinguipedidae	<i>Parapercis hexophtalma</i>
Tokek		
Ikan Kuwe Sirip	Carangidae	<i>Caranx melampygus</i>
Biru		
Ikan Buntal	Tetraodontiforme	<i>Arothron meleagris</i>
	s	
Ikan Singa	Scorpaenidae	<i>Pterois volitans</i>
Ikan Singa Afrika	Scorpaenidae	<i>Pterois mombasae</i>
Ikan Moray	Muraenidae	<i>Gymnothorax favagineus</i>
Ikan Kerapu	Epinephelidae	<i>Epinephelus merra</i>
Musang		
Ikan Tangkur	Syngnathidae	<i>Corythoichthys haematopterus</i>
Gosong		

Utilizing Local Potentials in Rubiah Island as a Biology Learning Resource

Utilizing local potential as a learning resource has been widely implemented in various biology topics. This utilization has had numerous positive impacts on the learning process (Putri & Artanto, 2025), improving conceptual mastery (Trisianawati et al., 2019; Wilujeng et al., 2024), increasing learning completion (Hafizah et al., 2022), enhancing environmental literacy (Khairani et

al., 2023), enhancing conservation understanding and awareness (Nurfatonah & Aminatun, 2025), effectively improving process, generic, and critical thinking skills, and scientific attitudes (Wilujeng et al., 2017, 2020), and facilitating student understanding of concepts, increasing learning motivation, and enhance awareness and a sense of responsibility for protecting and preserving the environment (Keliat et al., 2025).

Table 3. List of Local Biological Potentials as Relevant Biology Learning Resources

Local Potential Use	Biological Topic	Category
Coral Reef Ecosystem	Biodiversity Animalia Ecosystem Classification of Living Things Environmental Balance & Change	The use of biology learning resources based local potential by utilization
Coastal Area	Ecosystem Environment Environmental Change Ecology	The use of biology learning resources based local potential by utilization

This utilization of local potential can be appropriate with the various of materials needed. Several studies have described the utilization of local potential in the ecosystems (Safitri & Anas, 2023; Setiyanika et al., 2023), biodiversity (Manalu & Suhartini, 2023; Nusantari & Lihawa, 2017; Triannisa & Yuliyanti, 2024), inheritance patterns (Rosalvin et al., 2022), animalia (Juniarti et al., 2024; Tanjung et al., 2023), plant structure and its

utilization (Kasrina et al., 2019; Romadhan et al., 2024), conservation (Erfariyah et al., 2024), and environmental change and bacteria (Imtihana & Djukri, 2021).

Based on the analysis, it was found that the utilization of local biodiversity potential on Rubiah Island has not been able to accommodate whole biological materials and only covers a few of concepts. The forms of utilization can be seen in Table 3.

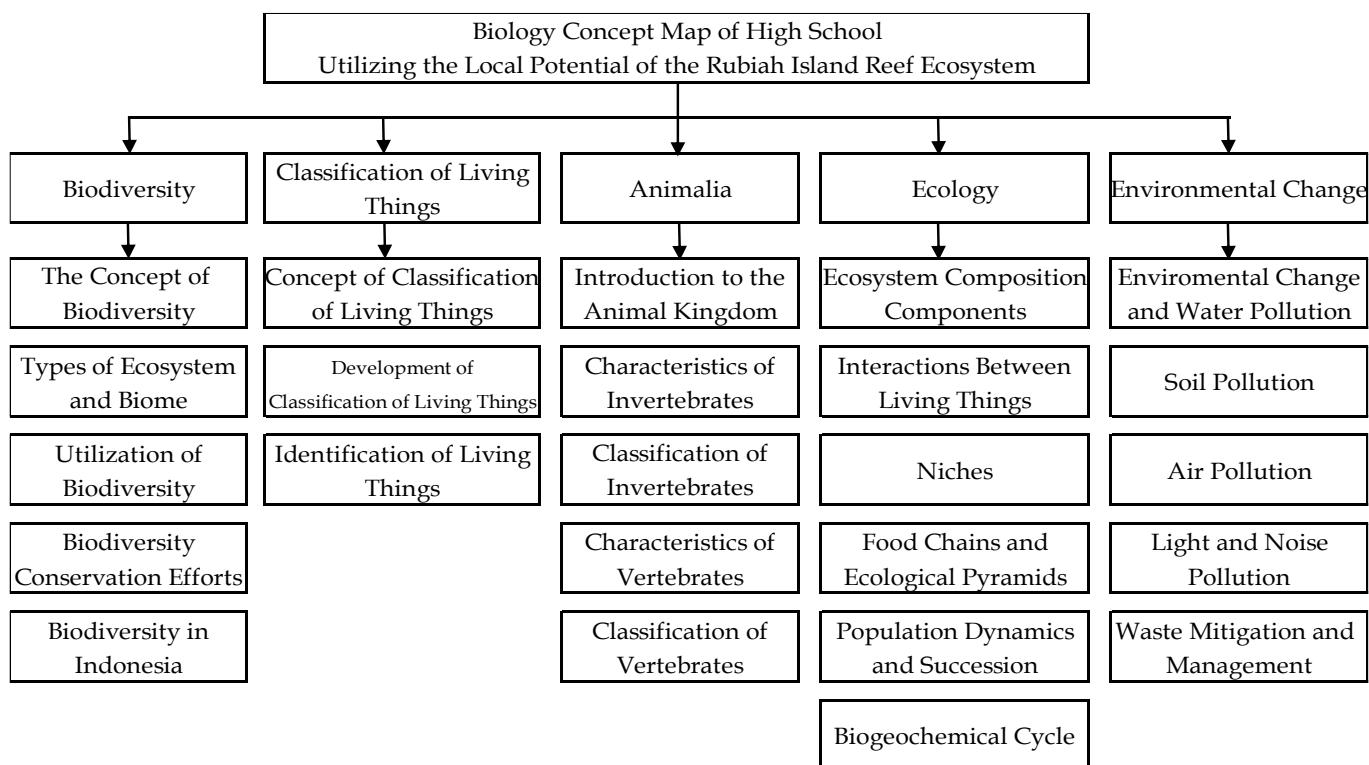


Figure 2. Concept map of biology material through the utilization of local coral reef potential

Utilizing local resources in biology learning is a way to strengthen students' mastery of biology concepts while at the same time training them also to maintain environmental balance. This also aligns with the Indonesian curriculum's requirement that learning integrated with local resources can be relevant with the unique characteristics of each region, suitable for student needs, more applicable and meaningful. Fundamentally, utilizing local resources for biology learning provides more realistic learning experience and is relevant with the students' current environment. This has a positive impact on increasing insight and knowledge, as well as impacting changes in attitudes and behaviors that are pro-environment.

Mapping of research on the use of local resources on Rubiah Island as a source of biology learning for high school students can be described in Figure 1. Based on this material mapping, both educators and students can further explore the concepts of the material to be studied. The biodiversity material can include concepts of ecosystem-level biodiversity (in this case, coral reef ecosystems), environmental factors causing biodiversity, types of coral reef ecosystems, benthos, other marine ecosystems, aquatic biota, the distribution of aquatic flora and fauna, the benefits of biodiversity in coral reef ecosystems, the impact of uncontrolled exploitation on organisms, conservation efforts, and conservation areas. Furthermore, in the material on the classification of living things, concepts that can be further explored include the definition of a phylogenetic tree, the definition of a domain, the levels of taxa in living things, the basics of classification of living things, the phylogenetic classification system, the purpose of classification of living things, the definition of taxonomy, and the definition of categories and levels of taxa.

The exploration can also be implemented in the animalia material while these concepts can be studied in depth, including segmentation in animals, classification of animals based on body cavities, basic characteristics of animal classification, phylogenetic diagrams of animals, characteristics of the animal kingdom, characteristics of invertebrates, characteristics of vertebrates, classification of invertebrates and vertebrates. Meanwhile, in the ecology material, concept development includes biotic and abiotic components and their interactions between the two in coral reef ecosystems, interactions between fellow biotic components (in this case, it could be reefs and fish), habitats and niches, food chains and webs that are formed, ecological pyramids, community changes, key species and invasive species, ecological productivity in coral reef ecosystems, the water cycle and the carbon cycle.

Furthermore, the material on environmental changes can include concepts such as community waste as a pollutant of land and water, causes of changes in the aquatic environment, biological parameters, bioindicators of unpolluted waters, parameters of polluted marine waters, activities that cause environmental imbalance, the impact of natural disasters on coral reef ecosystems, application of mitigation of changes in the aquatic environment, types of waste, the concept of 3R (reduce, reuse, and recycle), recycling processes, and waste management. Based on this description, the coral reef ecosystem that can be used as a source of learning biology is shown as follows.



Figure 3. Coral reef ecosystems as a biology learning resource

In general, the use of local potential as a biology learning resource can be categorized based on its utilization and design. This study found that local coral reef potential can be utilized as a learning resource through its utilization (Figure 3). It does not require special design and can be directly applied and used in the learning process. Integrating local potential into biology learning offers promising opportunities for innovative and engaging learning experiences. Furthermore, numerous studies have emphasized the importance of utilizing local potential as a learning resource to increase student engagement and understanding (Asara et al., 2024; Manalu & Suhartini, 2023).

Utilizing local biodiversity in biology education has been massive and multidimensional potential. Kartuti. et al. (2016) demonstrated that learning tools based on local mangrove ecosystems effectively improve students' soft skills and learning outcomes. Muhsafahroyin et al. (2020) emphasized that utilizing the surrounding environment as a learning resource is part of contextual learning that provides students with hands-on experience. Nurmala et al. (2019) added that learning biology directly in the environment can foster students' interest in biology. Andriyani et al., (2021) also demonstrated the potential of ethnozoology as a learning resource that can be developed into learning media such as booklets.

Ramadhani et al. (2024) revealed that the utilization of local biodiversity can be a source of project-based learning to internalize character values in strengthening the Pancasila students profile, especially in areas with unique geographic characteristics such as coastal areas. Amdah et al. (2024) also showed that local knowledge about managing biological natural resources has high educational value as a non-formal learning resource that can support environmental conservation and community capacity building.

Overall, the use of local biodiversity in biology education not only increases the effectiveness of learning but also integrates aspects of conservation, character, and local wisdom in a holistic learning approach.

Conclusion

The results of this study concluded that the local potential of the Rubiah Island coral reef ecosystem, including the types of coral, reef fish, and benthic animals, has significant local potential and can be utilized effectively as a biology learning resource for biodiversity materials (types, benefits, and values), classification of living things, animals, ecology, and environmental changes. Based on this study, the author can recommend further research on the exploration of broader local potential and the development of relevant teaching materials.

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Author Contributions

Conceptualization was carried out by AN & DA; data curation were handled by AN & DA; review and editing handled by DW & SI; all authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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