RESEARCH ARTICLE

The potential of folklore as biodiversity learning resources in high school

Rexy Maulana Dwi Karmadi [a,1,*], S.Suhartini [a,2] , Ahmad Adnan Mohd Sukri [b,3]

[a] Department of Biology Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Jl. Colombo No.1, Yogyakarta 55281, Indonesia

[b] School of Educational Studies, University of Science Malaysia (USM), 11800 Gelugor, Penang, Malaysia

[1]rexymaulanadwikarmadi@gmail.com*; [2]suhartini@uny.ac.id, [3]adnan91shukri@gmail.com

Abstract: Learning resources are everything that can be used to facilitate the learning process. Folklore is one of the cultural products that can be innovated as a biodiversity learning resource in high school. This study reviewed relevant literature regarding folklore from various regions of Indonesia to examine and analyse the potential of folklore as a learning resource for biodiversity. The descriptive analysis revealed that the contents of folklore can be used to study examples of the biodiversity level, the regional distribution of Indonesia's biodiversity, flora and fauna characteristics of Oriental, Australian, and Transitional, benefits of biodiversity and its conservation efforts. In addition, folklore as a learning resource also has the potential to develop student competencies such as environmental care, creative thinking, critical thinking, and problem-solving. However, the folklore content cannot describe all the material on biodiversity, therefore it must be combined with other learning resources for use in the biodiversity learning process.

Keywords: biodiversity; folklore; learning resources

For correspondence:
rexymaulanadwikarmadi@gmail.com

Article history:
Received: 4 September 2022
Revised: 31 January 2023
Accepted: 2 February 2023
Published: 25 February 2023

10.22219/jpbi.v9i1.22502

© Copyright Karmadi *et al*. This article is distributed under the terms of the Creative Commons Attribution License

p-ISSN: 2442-3750
e-ISSN: 2537-6204

How to cite:

Karmadi, R. M. D., Suhartini, S., & Sukri, A. A. M. (2023). The potential of folklore as biodiversity learning resources in high school. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *9*(1), 74-89. https://doi.org/10.22219/jpbi.v9i1.22502

Introduction

Learning resources are anything that can be used as a means to learn information, improve the quality of learning, and be prepared before learning begins, even before students arrive in class (Siemens, 2013; Supriadi, 2017; Yustika, 2017). The availability of learning resources is one that influences the effectiveness of learning because it allows the growth of students' learning culture independently as a basis for habituation in later life and creates communication between children and adults as well as with peers. Therefore, the existence of learning resources is very important and becomes one of the pillars of learning activities in schools, and is definitely needed in achieving educational goals in schools (Dewi & Ibrahim, 2019; Hodson, 2014; Suhirman, 2018; Yustika, 2017).

For students, learning can be done anywhere, anytime, and through anything, because various types of learning resources are everywhere, while for teachers, many resources can be utilised and managed in the learning process, whether intentionally provided or which are widely available around us (Huang, 2015; Supriadi, 2015; Tejokusumo, 2014). Learning sources can include interactions between peers, educators, educational content, available technology, experiences of the students themselves, appreciation of the culture that surrounds students, the environment around students, and currently developing science (Rambe & Bere, 2013; Rikarno, 2015).

Local wisdom can also be used as a learning resource for biology in school. For example, the local wisdom of the Ende tribe in East Nusa Tenggara, Indonesia, namely *tambi uma* or the garden hoe activity has the potential to be used as a source of learning biology, especially about ecosystems, and human excretory and musculoskeletal systems. These learning resources can also be used for character education because they contain noble character values such as mutual cooperation, brotherhood, responsibility, obedience, gender equality, social values, and communicative values (Lidi et al., 2021). Another example that shows the potential of local wisdom as a source of learning biology is in the processing of cassava (*Manihot utilissima*) into Sanjai chips in West Sumatra, Indonesia. The process of making sanjai chips

involves local knowledge (indigenous science) related to biological concepts, especially the benefits of biodiversity (Wulansari et al., 2022).

Local wisdom can indeed be used as a source of learning biology because it conserves values and preserves natural resources which must be known, understood, and preserved by the nation's generation through education, especially by learning in schools. The use of local wisdom in learning biology has the potential to develop literate students with character, and at the same time, act as conservation agents (Alimah, 2019; Ardan, 2016). However, learning resources based on local wisdom in schools are not currently very popular and industrial progress in various fields is not directly proportional to the continued existence of local wisdom. Consequently, the potential of local wisdom possessed by various ethnic groups is not optimally integrated into learning in schools (Pornpimon et al., 2014; Sriyati et al., 2021), so educational research based on local wisdom should be more developed.

One of the local wisdom products that have the potential as a source of learning is folklore, that is, traditional beliefs, customs or stories originating from the community that are passed through generations by word of mouth. Folklore tells about existing phenomena and objects by explaining aspects of composition and structure, or aspects of processes and changes so that they become national characteristics of a diverse culture that includes cultural and historical riches (Bunga et al., 2020; Maulina, 2014). Also, folklore can convey information about the local wisdom of an area and easily influences the reader. This information is usually in the form of a mandate so that one does not act wrongly and in some stories, shows the richness of the forest ecosystem so that it can be used to instil ownership or attitude towards the natural environment. Therefore, the existence of folklore is a valuable element for education (Banda & Morgan, 2013; Rahman & Purwanto, 2021).

Biodiversity can be interpreted as all creatures that live on earth including all types of plants, animals and microbes, which are interconnected and need one another to grow and develop to form a living system. Biodiversity is an important component in the sustainability of the earth and its contents, including human existence (Verma, 2016; Widjaja et al., 2014). In Indonesia, learning about biodiversity in schools is directly contained in the Minister Regulation in Education and Culture No. 24 of 2016 concerning core competencies and basic competencies in basic education and secondary education, namely Basic Competencies (KD) 3.2: analyzing various levels of biodiversity in Indonesia and their threats and conservation.

Previous studies have discussed the relationship between folklore and biodiversity. The Tiv people of Central Nigeria have local beliefs regarding certain species and locations which are symbolised in the form of totems. They provide full protection to the things associated with the belief including the plants and animals associated with the totem so that their survival is less threatened compared to other useful species in the area. This shows that there is a relationship and an important role of folklore in the form of totemism passed down from generation to generation with the conservation and management of biodiversity (Dagba et al., 2013). Ghanaian folklore and traditional songs play an important role in addressing environmental issues including the preservation of biodiversity. It has been observed that Ghanaian folklore texts including indigenous songs have a moral foundation that ensures conformity of behaviour with the social norms that instil discipline and a sense of commitment to the proper care and management of the flora, fauna and their physical environment (Amlor & Alidza, 2016). The cuckoo's call, reflecting the remaining life of the farmer in the local environment, is a belief passed down from ancient times in the northern part of Denmark. The number of syllables per song in the cuckoo calls increased with the size of the farm because larger fields were attended by more cuckoos. The presence and sound of cuckoo calls is a reliable indicator of biodiversity because the abundance of cuckoos implies greater species richness of birds in general. The extent of agricultural land and high biodiversity can indicate the prosperity of a farmer, giving rise to the assumption that the farmer's remaining life is still long. This demonstrates the potential importance of folklore in studying human relationships with biodiversity, and thus the potential for linking folklore to conservation (Møller et al., 2017). People in the Rarh region of West Bengal practice the use and protection of various plants and animals through a folkloric approach, therefore folkloric practices carried out by the people for years play an important role in solving various socio-ecological problems and must be preserved for ecological sustainability including biodiversity (Biswas, 2018). Residents of the Doornhoek plantation in Mpungalanga, South Africa, teach their children to follow several rules to preserve biodiversity. Children observe their parents following these rules and thus avoid killing and destroying flora and fauna for fear of the consequences of superstition. Hence, folklore in the form of taboos and superstitions has proven to be effective as a tool to instil fear of the consequences of its violations, ultimately leading to the sustainability of biodiversity (Mndawe, 2019). Most species (28 out of 35 mammal species studied) in the Eastern Himalayan ecoregion are protected by various forms of taboos from their associated communities, indicating that many indigenous cultures such as folklore passed down from generation to generation support wildlife conservation (Janaki et al., 2021). The folklore of *Yadu Usuk* from the Tidung Tribe, North Kalimantan, Indonesia, teaches the prohibition of *Gasab* (using other people's things without the owner's permission) and contains ethnoecological aspects related to traditional efforts to conserve biodiversity by the Tidung people based on the *Gasab* philosophy and are suitable for use as media for learning about biodiversity in schools. This shows that folklore has a connection with biodiversity and can be integrated into learning in schools (Suciyati & Abrori, 2021).

The seven studies reviewed show how important the existence of folklore is in efforts to preserve biodiversity. Previous studies have revealed the link between folklore and biodiversity from both the utilization and conservation aspects, as well as research topics related to the feasibility of folklore-based

teaching materials in learning biodiversity in schools. Nonetheless, there is still no clear description of the process of filtering and transferring the contents contained in folklore for use in learning about biodiversity in schools, as if there is a "missing link" between the two research topics. Therefore, this study contributes to explaining the extent to which folklore content can reach biodiversity material in schools, so that it can act as a bridge between the potential of the contents and values contained in folklore and the need for biodiversity learning resources, as well as enriching information related to the potential of folklore as a source of learning biology. In addition, the study results can be used as a basis for the development of folklore-based teaching materials for biodiversity or learning in schools and development research in the field of biology education.

Method

This qualitative research involved a review of the literature related to folklore as a source of learning biodiversity. The data were collected in the form of quotes from words, phrases and sentences in folklore books from various regions in Indonesia and other related books. The folklore source books used in this study were obtained by conducting exploratory studies to discover the potential for local wisdom, especially in this case as a source of learning biology (Adlina & Syahlan, 2019; Alimah, 2019; Suarmika et al., 2020). The source books of folklore obtained from the exploratory study are provided in Table 1.

Table 1. Books used as folklore sources

No.	Folklore Source Books
1	Maulina & Kurniati. (2010). 21 Cerita Rakyat Bumi Lancang Kuning (21 Folklore from Land of Yellow Boat). Balai Bahasa Provinsi Riau
2	Asfar. (2014). Asal Mula Rombok Manangar: Antologi Cerita Rakyat (The Origin of Manangar Waterfall: Folklore Anthology). Balai Bahasa Provinsi Kalimantan Barat
3	Tim Proyek Penelitian dan Pencatatan Daerah. (1978). Cerita Rakyat Daerah Jawa Timur (Folklore from East Java). Proyek Penerbitan Buku Bacaan dan Sastra Indonesia dan Daerah
4	Tim Penelitian dan Pencatatan Kebudayaan Daerah Provinsi Sulawesi Selatan. (1977). Ceritera Rakyat Daerah Sulawesi Selatan (Folklore from South Sulawesi). Proyek Pengembangan Media Kebudayaan
5	Kurniawati. (2016). Tobara dari Bone Talondo: Cerita Rakyat dari Sulawesi Barat (Folklore from West Sulawesi). Badan Pengembangan dan Pembinaan Bahasa
6	Erdmann. (2004). Panduan Sejarah Ekologi Taman Nasional Komodo (Guide to the Ecological History of Komodo National Park). The Nature Conservancy
7	Asrif & Hasan. (2019). Antologi Cerita Rakyat Pulau Buru (Anthology of Buru Island Folklore). Kerjasama Kantor Bahasa Maluku Badan Pengembangan Bahasa dan Perbukuan dengan De La Macca
8	Asrif & Kumbangsila. (2019). Antologi Cerita Rakyat Pulau Ambon dan Pulau-Pulau Lease (Anthology of Ambon Island Folklore and Lease Islands Folklore). Garis Khatulistiwa (De La Macca Grup)
9	Widodo. (2010). 10 Cerita Rakyat Papua Terpilih (10 Selected Papuan Folklore). Kerjasama Balai Bahasa Jayapura Kementrian Pendidikan Nasioanl dengan CV. Prasasti
10	Dharmojo & Jaruki. (2005). Antologi Cerita Binatang dari Tanah Papua (Anthology of Fable from the Land of Papua). Pusat Bahasa Departemen Pendidikan Nasional
11	Somad et al. (2007). Aktif dan Kreatif Berbahasa Indonesia untuk Kelas X SMA/MA (Active and Creative Indonesian Language for Tenth Grade Senior High School). Pusat Perbukuan Departemen Pendidikan Nasional

After the book source was obtained, folklore samples were selected by purposive sampling for integration into the study of biodiversity. The data obtained were analysed and presented descriptively in tables to facilitate the reader's understanding. The model of folklore integration in biodiversity learning is shown in Figure 1.

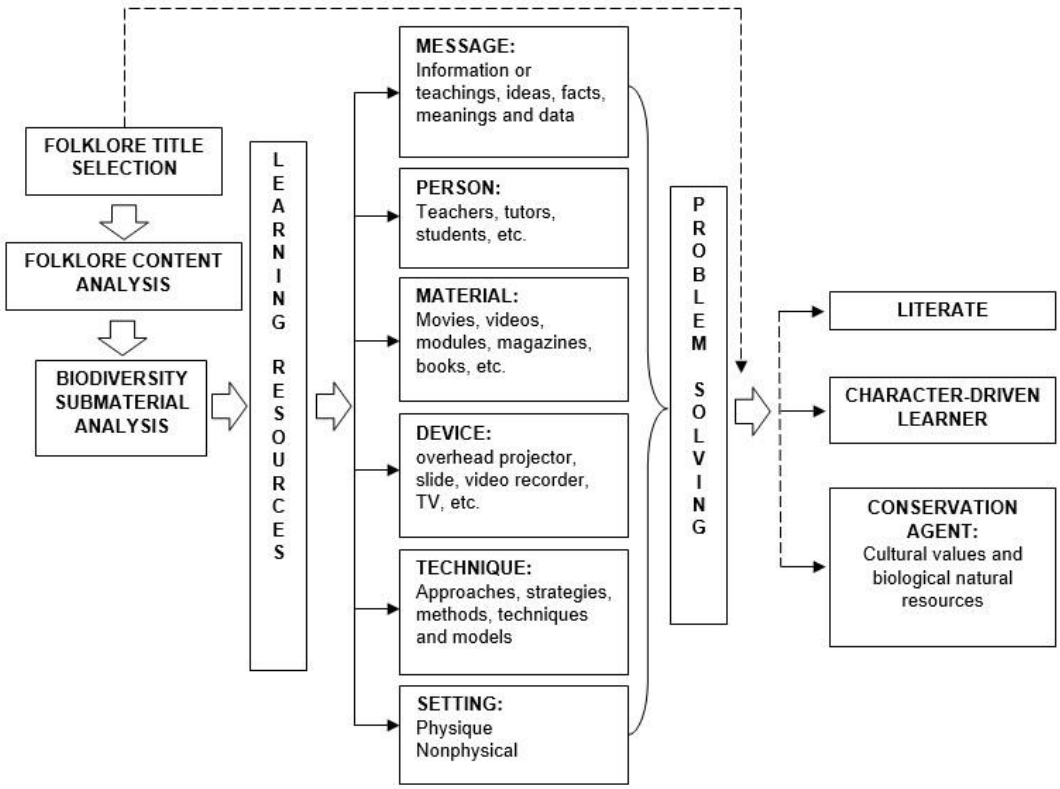

Figure 1. Model of folklore integration in biodiversity learning (Modified from Alimah, 2019)

Results and Discussion

Folklore as Source of Learning

Learning resources can be in the form of human or non-human as well as learning resources that are designed or utilised. Learning resources by design are specifically designed or developed as a component of an instructional system to provide directed and formal learning facilities, while learning resources by utilization are not designed specifically for learning purposes but can be found, applied and utilised for learning purposes (Junaidi, 2019; Subqi, 2016; Tejokusumo, 2014). Folklore is included in the learning resources by utilization as its presence can be found both directly in people's lives and indirectly in various literature, the advice of the story can be applied, and the information contained in it can be used to study biodiversity, instil the conservation values and character that contained in the local wisdom, as well as for the preservation of natural resources.

Folklore is a collection of traditional beliefs, customs, and stories from a community that are passed down from generation to generation by word of mouth so they are also considered a means of communication between generations and a place of experience from the old to the new (Altwaiji, 2017; Michalopoulos & Xue, 2021). The most important aspect of folklore is the presence of moral, religious, and educational values, morals, and other positive values, all of which can shape the character of students. By presenting two contradictory elements, namely good and bad, folklore can also help students understand why some species are hunted and consumed while others are killed or simply ignored for no apparent reason (Fitriani et al., 2020; Jugli et al., 2020; Maulina, 2014).

Biodiversity

Biodiversity refers to the variety of life on Earth, which is made up of millions of plants, animals, microorganisms and the genes they contain. Biodiversity can also be defined as the presence of various species of plants and animals in their natural environment or the diversity of plant and animal life in certain habitats (Kilinc et al., 2013; Verma, 2016). Biodiversity consists of three levels, namely genetic, species, and ecosystem diversity. Gene or genetic diversity is the variation of genetic information contained in all individual plants, animals and microorganisms that occur in a population of species, while species diversity is the variation of various species or living organisms. Ecosystem diversity can be interpreted as variations

in habitats, biotic communities and ecological processes in the biosphere (Rawat & Agarwal, 2015; Verma, 2016).

Indonesia has a high level of biodiversity supported by its geographical location with a distribution of islands that classify flora and fauna into three types, namely Asiatic/Oriental, Australis, and Transitional types (Herlambang et al., 2016; Morrone, 2015). The distribution of flora and fauna in Indonesia is divided into three areas, namely the Sunda shelf in western Indonesia (Sumatra, Java, Kalimantan, Bali) (Asiatic/Oriental), the Sahul shelf area in eastern Indonesia (Papua and the small islands around it) (Australis), and the Transitional Area (Sulawesi, Maluku, Sumbawa, Sumba, Lombok, and Timor) (Wallacea). The areas are separated by the Wallace line, the Weber line, and the Lydekker line (Crayn et al., 2015; Irnaningtyas, 2016; Setiawan, 2022).

The existence of biodiversity can function in regulating and maintaining climate stability, water systems, soil fertility, air quality and overall health of life support systems on earth. Biodiversity can also be used as a source of food, animal feed, fuel, fibre, shelter, medicine, industrial raw materials, building materials, and a source of income (Pushpangadan et al., 2018; Roy et al., 2013). Consequently, the loss of biodiversity can be caused by pollution, loss of habitat, poaching, presence of introduced species, over-exploitation of preferred species, climate change, natural disasters, extinction of predatory species in an ecosystem, urbanization, food shortages, and other outbreaks or diseases (Shah et al., 2022; Singh et al., 2021).

In situ and ex situ conservation can be used to deal with threats to biodiversity. In situ conservation is the protection of species, genetic variation and habitat in their natural ecosystems, while ex situ conservation is a method or means of protecting plant species, wildlife and micro-organisms and genetic varieties outside their natural habitat (Braverman, 2014; Hadijah et al., 2021). In addition, efforts to overcome threats to biodiversity can also be performed through education in schools to increase the awareness of the younger generation of the importance of biodiversity for the sustainability of human life. School is the most appropriate place to instil all forms of character education, including the character of loving the environment (Pamungkas et al., 2022; Rahayu et al., 2021).

Titles Selection and Folklore Content Analysis

The selection of folklore titles for the eleven reference books used the criteria for stories containing content related to biodiversity learning resources to select fifteen folklore samples assuming that there is an element of biodiversity in folklore closely related to the science of literary ecology (Table 2).

Literary ecology is the science of the mutual relationship between the environment and its creatures, so in this case, it is understood that literary works and the environment cannot be separated from one another. Literary ecology describes the reciprocal relationship between characters and the environment and is considered important to bring a story to life. The natural, social, and cultural environment is always presented concretely in imaginative texts. Literary realism and naturalism have shown how literary texts always express forms of ecological thinking (Amanat, 2019; Sawijiningrum, 2018). Content analysis was then performed to obtain information about the form and benefits of flora and fauna in folklore, the regional background, conservation messages as well as quotes to be used in learning biodiversity (Table 3).

Table 2. Folklore titles with flora and fauna found

Folklore Titles	Flora and Fauna Found (*Species*/ Family/ Order/ Class)
Batu Gajah	Sago (*Metroxylon sagu*), Meranti (*Shorea sp.*), Rattan (*Calamus rotang*), Mara/Mahang (*Macaranga tanarius*), Onge, Daru-daru, Chestnut (*Platanus sp.*), Himalayan screw pine (*Pandanus furcatus*), Chengal (*Neobalanocarpus heimii*), Keruing (*Dipterocarpus sp.*), Sialang (*Koompassia excelsa*), Kuras (*Dryobalanops sp.*), Asam Kandis (*Garcinia xanthochymus*), Kelubi (*Eleiodoxa conferta*), Kapau, Bamboo (Poaceae), Banana (*Musa sp.*), Elephant (*Elephas maximus*), Hornbill (Bucerotidae), Deer (Cervidae), Muntjac (*Muntiacus muntjak*), Selais Fish (*Kryptopterus lais*), Snakehead Fish (*Channa micropeltes*), Bee (Apidae)
Kisah Antuyut	Antuyut/Pitcher Plant (*Nepenthes sp.*)
Raden Sandhi	Bear (Ursidae), Deer (Cervidae), Muntjac (*Muntiacus muntjak*), Mouse-deer (*Tragulus sp.*), Snake (Squamata), Bird (Aves)
Sandhekala	Tiger (*Panthera tigris*), Goat (*Capra aegagrus*), Bird (Aves), Grasshopper (Orthoptera)
Asal Mula Pohon Jati Besar-Besar	Teak (*Tectona grandis*), Muntjac (*Muntiacus muntjak*)
Tobara dari Bone Talondo	Ebony (*Diospyros sp.*), Coconut (*Cocos nucifera*), Bamboo (Poaceae), Long Beans (*Vigna unguiculata*), Corn (*Zea mays*), Gadung (*Dioscorea hispida*), Sago (*Metroxylon sagu*), Banana (*Musa sp.*), Rice (*Oryza sativa*), Anoa (*Bubalus sp.*), Buffalo (Bubalus bubalis), Pig (*Sus sp.*), Wild Chicken (*Gallus sp.*), Kampong

Folklore Titles	Flora and Fauna Found (*Species*/ Family/ Order/ Class)
	Chicken, (*Gallus gallus domesticus*), Fish (Pisces), Shrimp (Malacostraca), Bird (Aves), Dog (*Canis lupus familiaris*)
Bola Emas Burung Maleo	Mamoa Bird (*Eulipoa wallacei*)
Legenda Putri Naga Komodo	Komodo Dragon (*Varanus komodoensis*), Deer (Cervidae)
Asal Mula Pohon Kayu Putih	Cajuput (*Melaleuca leucadendra*)
La Mellong	Sandalwood (*Santalum album*), Chicken (*Gallus sp.*)
Patung Mbis dan Burung Kasuari	Sago (*Metroxylon sagu*), Cassowary (*Casuarius sp.*), Bird-of-paradise (Paradisaeidae), Parrot (Psittacidae), Cuscus (Phalangeridae), Wild Boar (*Sus sp.*)
Enggang dan Kasuari	Nutmeg (*Myristica fragrans*), Hornbill (Bucerotidae), Cassowary (*Casuarius sp.*)
Anjing Kili Bahe dan Kangguru	Kangaroo (Macropodidae), Crocodile (*Crocodylus sp.*), Dog (*Canis lupus familiaris*)
Asal Mula Pohon Sagu	Sago (*Metroxylon sagu*), Matoa (*Pometia pinnata*), Nibung (*Oncosperma tigillarium*), Breadfruit (*Artocarpus altilis*), Melinjo (*Gnetum gnemon*), Rattan (*Calamus rotang*), Pandan (*Pandanus sp.*), Bamboo (Poaceae), Wild Boar (*Sus sp.*), Babi Tanah, Cuscus (Phalangeridae), Rat (Muridae), Parrot (Psittacidae)
Kakatua dan Taun-Taun	Matoa (*Pometia pinnata*), Cockatoo (Cacatuidae), Hornbill (Bucerotidae)

Table 3. Benefits and roles of flora and fauna in folklore

Folklore Titles and Its Origin (Province)	Benefits and Roles of Flora and Fauna in The Story	Sentences that Describe (Translated and Adjusted)
Batu Gajah (Riau)	As source of building materials, food, and tools	"….a house on stilts made of wood, with high pillars, and a roof with sago leaves." "….catch fish in the river…. looking for fruit, resin, rattan, honey, and forest animals such as deer, muntjac, and others….he tethered the canoe on the branch of the kelubih tree that lay down to the river bank." "...throwing the wooden stick of chengal at the elephants who were drinking in the river."
	Biotic components of river, riparian and forest ecosystems in Riau	"He dug up the sandy soil on the bank of the river, put in the seeds of the kapau, and poured a small amount of water on it." "The powerful Datuk who is said to be able to stand on a banana frond,…" "Dozens of hornbill hovering over the river,….A selais fish the size of a child's wrist was caught in its beak's clasp…." "Himalayan screw pine are lined up separately on both sides of the river….Usually around the roots of that plant, the snakehead fish nest…" "Branches of kuras, kandis, and kelubih interspersed among the thickets of Himalayan screw pine, fell into the river so that some of the leaves were in the water." "The land on either side of the river is covered with dense forest which looks dark and scary. Large trees such as meranti, mahang, onge, brangan, chengal, and daru-daru grow a lot in the jungles of the Tapung River…. kruing and sialang trees that bees use as nesting sites."
	Reminding the importance of managing human settlements	"After almost the whole village was ravaged, the elephants….. flocked through the village and returned to the Huran Wide where they came from."

Folklore Titles and Its Origin (Province)	Benefits and Roles of Flora and Fauna in The Story	Sentences that Describe (Translated and Adjusted)
	adjacent to wild animal habitats without causing conflict	
Kisah Antuyut (West Kalimantan)	As a tool and as a biotic component of the forest ecosystem in West Kalimantan	"Until now, the roots of Antuyut live in the moist forest and are usually used as traditional ropes."
Raden Sandhi (West Kalimantan)	As prey, pets, and and as a biotic component of the forest ecosystem in West Kalimantan	"...go to the forest, or go to the Paloh area to hunt for birds, deer, muntjac." "If I chopstick, hopefully the bird doesn't die and I can keep it..." “….you know in the forest. Animals are many, such as snakes, bears, and other animals that can trouble us,….”
	Teaches not to carelessly kill animals in the forest	“"Never kill useful animals such as birds (any kind) and others."
Sandhekala (East Java)	As a source of livestock, pets, pet feed, and as a biotic component of forest ecosystems in East Java	"The herd of goats are many and fat." “Sentot is still playing at the edge of the forest….. What, mom? I'm still looking for grasshoppers for bird food." "...that nearby there is a tiger seeker..."
Asal Mula Pohon Jati Besar-Besar (East Java)	As a material for making traditional musical instruments	"One of the teak trees was cut down to make a bedug (traditional drum),..."
	Teaches not to treat animals arbitrarily	“Soon the baby deer was buried alive and secretly….. Hi, Sang Prabu, you have buried an innocent child alive. So now feel my recompense.”
	As a biotic component of the forest ecosystem in East Java	“….he went to the forest. There he approached a teak tree,…”
Tobara dari Bone Talondo (West Sulawesi)	As a source of food, cultivation, livestock, pets, and customary law equipment	“The side dishes served are buffalo, pork and chicken. The meat is mixed with kallipoa leaf vegetables cooked in bamboo or called bebik.” “Farm animals, such as jungle fowl and native chickens, are kept in bamboo cages. Dogs do not have special cages. Anoa, pigs and buffalo are free to roam behind the house but they are still given a fence.” “Besides growing rice, they also grow corn, gadung or what is called kundo, sago, and bananas. … They grow long beans.” “The harvested coconuts are processed into dry coconut called copra. The copra is then processed into oil. The residents are diligent in making cooking oil which they call kaluku.” “….for example stealing, the perpetrator will be punished. Offenders who violate customs are subject to fines. The fine is

Folklore Titles and Its Origin (Province)	Benefits and Roles of Flora and Fauna in The Story	Sentences that Describe (Translated and Adjusted)
		in the form of buffalo or can be replaced with money or chicken according to ability.”
	As a natural “alarm”	"Before the morning sun shines brightly, the rooster crows. The sound of a rooster crowing wakes up some of the residents who are still asleep to get ready for the morning activities.”
	As a biotic component of river and mountain forest ecosystems in West Sulawesi	“On that mountain black-wood trees thrive. The black-wood tree is a typical wood tree in Sulawesi. Black-wood is also called ebony." “The chirping of the birds resonated with each other….. The kaluku (coconut) tree swaying in the wind…. In the mountains there is also a river whose water is very clear. Seen fish swimming while in groups, …. On the bank of the river there are big shrimps."
La Mellong (South Sulawesi)	As a place to rest and as a material for weaving looms	"Cenrana (sandalwood) in question is a wooden tree where the Bone troops rest when they will attack Soppeng, the wooden tree will be made into ganra (weaving tools) for the Bone people."
	As a natural “alarm”	"Just the first sound of a rooster in the early hours of the morning, the head of Jowa Soppeng ordered the troops to surround the Bone troops."
Legenda Putri Naga Komodo (East Nusa Tenggara)	As a prey	“….Si Gerong who was hunting in the forest, killed a deer.”
	As a biotic component of the forest ecosystem in East Nusa Tenggara and teaches not to carelessly kill animals	“Si Gerong raised his spear to kill the lizard,…. Quickly, she separated them, and told Si Gerong, “Don't kill this animal, she is your sister, Orah. I gave birth to you. Consider him your neighbor because you are twins."
Asal Mula Pohon Kayu Putih (Maluku)	As a source of medicine	One day a very beautiful tree will grow. You can use it for medicine, to help sick people who need help… The people around Mount Kapala Mada call the tree Kayu Putih (Cajuput).”
Bola Emas Burung Maleo (Maluku)	As a source of livestock	"He will manage the results of the maleo (the species found in Maluku is called mamoa) eggs for a year."
Kakatua dan Taun-Taun (West Papua)	As a biotic component of the ecosystem in Papua's forests	“One day the parrot was looking for food alone in the forest. He perched on a big matua (matoa) tree and was full of fruit… the year-old bird (hornbill) peeked under the matua tree.”
Enggang dan Kasuari (West Papua and Central Papua)	As a biotic component of forest ecosystems in West Papua and Central Papua	“One day the hornbills and the cassowary flew in looking for food. In the forest there is a nutmeg tree. The tree bears fruit. Hornbills and cassowaries perched on the tree."
Patung Mbis dan Burung Kasuari (Papua)	As a material for making houses, clothes, mats, and as a biotic component of the forest ecosystem in Papua	“They went to the honai (traditional house of the Asmat community) for their daughter. They then opened the sago leaves and reed grass that covered the place where Mbis was shackled to his freedom….and closed the tapin (mat made of woven sago leaves) in a emaciated, limp, and withered state.” “The awer (skirt) that I use is made from the leaves of sago palm (sago) which are still fresh. My head is also decorated with cuscus skin, decorated with feathers of birds of paradise and colored parrots. I must look really pretty."

Folklore Titles and Its Origin (Province)	Benefits and Roles of Flora and Fauna in The Story	Sentences that Describe (Translated and Adjusted)
	As a prey	"….bringing a wild boar that he had hunted."
Anjing Kili Bahe dan Kangguru (Papua)	As a biotic component of the forest ecosystem in Papua	"To the south of Lake Sentani, ... there is a place called Emehole Koi Yau (kangaroo dance venue) because many kangaroos gather .... The kangaroos then stomped their feet while chanting: Hunting in the jungle,..." "I didn't catch a single kangaroo," said the Kili Bahe Dog disappointed. When the Kili Bahe Dog complained, a crocodile appeared on the surface of the water."
Asal Mula Pohon Sagu (Papua)	As building materials, food, cooking tools, and as a biotic component of the forest ecosystem in Papua	"The vast forest is where they live, ... They make tall houses with materials that are already available in the forest, such as rattan rope, yetang (nibung leaves, erok (nibung midrib), and others." "….gathering their livelihood, then cooking and eating together. Their prey, namely wild boar, ground boar, cuscus, rats, and so on. In addition, they also collect vegetables, such as genemo (melinjo), aim (pandan fruit), breadfruit, anggam or yetet (matoa fruit), job sleigh, job tambuk, and so on." "What is that red ash-like thing that we eat often? ... Mama always takes it secretly and cooks it with bark, reeds, and rattan leaves for us to eat together." "Now in various places in Papua there are many sago swamps or sago hamlets, but in some places it only grows a little and there are even places where there are no sago trees at all."
	Plant seed disperser	"This unique object (sago palm fruit) is not obtained by working hard, but is brought by a wayur (parrot), either red, black, bluish green, or yellowish one day. "

Based on Table 2 and Table 3, there are flora and fauna content that can be used as a source of biodiversity learning, but these contents cannot describe the overall information of the material studied, therefore its use needs to be combined with other learning resources. Various learning resources basically should not be viewed partially. It should be seen as a unified whole in learning that can have a positive impact on learning outcomes (Subiyakto & Mutiani, 2019; Wulandari, 2020). In Table 2, each species of flora and fauna found can be used as an example of gene-level diversity by combining the content of the story with other types of learning resources such as pictures found on the internet, but it is necessary to consider choosing species with clearly visible phenotypic variations so that it is easy to observed by students. Then some content can also be used as a learning resource for examples of species diversity, where there are species of flora and fauna that are still in the same family, namely meranti, chengal, keruing, kuras (Dipterocarpaceae), rumbia, kelubi, rattan (Arecaceae), and deer and muntjac (Cervidae). The content in Table 3 can be used to study examples of ecosystem diversity, such as the text in the story of Batu Gajah which describes the characteristics of the biotic components of a forest ecosystem, namely "*The land on the left and right of the river is covered with dense forest which looks dark and scary. Large trees such as meranti, mahang, onge, brangan, chengal, and daru-daru grow a lot in the jungles of the Tapung River…. kruing and sialang trees that bees use as nesting places.*", then the biotic components of the riparian ecosystem described in the text "*The branches of the kuras, kandis, and kelubih trees intersect between the thickets of Himalayan screw pine, fall into the river so that some of the leaves are in the water. ….. Himalayan screw pine is lined up separately on both sides of the river…. Usually, around the roots of the Himalayan screw pine, the snakehead fish nest…".*
The folklore comes from various islands and archipelagos in Indonesia (Sumatra, Kalimantan, Java, Sulawesi, Nusa Tenggara, Maluku, Papua) so that they can be used in learning the sub-material of the distribution of Indonesia's biodiversity (Table 3). The flora and fauna in folklore grouped based on the distribution of Indonesia's biodiversity can also be used as a source for studying the characteristics of Asiatic, Australis, and Transitional flora and fauna (Table 2). In addition, the benefits and conservation messages implied by these stories can also be used as a source of learning about the benefits of biodiversity and its conservation efforts (Table 3).

Biodiversity Sub-Material Analysis

In Indonesia, the biology syllabus for the 10th grade, Basic Competence 3.2, divides the material on biodiversity into sub-concepts of gene diversity, species, ecosystems, Indonesian biodiversity, flora and fauna, and their distribution based on the Wallace line and Weber line, Indonesia's tropical rains uniqueness, utilization of Indonesia's biodiversity, and efforts to preserve Indonesia's biodiversity

(Kemendikbud, 2016). The five sub-materials were then adjusted to the material contained in the 10th grade biology textbook so that they were further divided into several sub-materials. Folklore content containing biodiversity learning resources was then used for sub-material analysis so that the use of learning resources can be designed more clearly and specifically (Table 4).

Table 4. Results of Biodiversity Sub-Material Analysis

Folklore Title	Can be used in learning on sub-materials													
	L1	L2	L3	D1	D2	D3	C1	C2	C3	C4	C5	C6	B	T
Batu Gajah	✓	✓	✓	✓	-	-	✓	-	-	✓	-	-	✓	✓
Kisah Antuyut	✓	-	-	✓	-	-	✓	-	-	-	-	-	✓	-
Raden Sandhi	✓	✓	-	✓	-	-	-	-	-	✓	-	-	✓	✓
Sandhekala	✓	-	-	✓	-	-	-	-	-	✓	-	-	✓	-
Asal Mula Pohon Jati Besar-Besar	✓	-	-	✓	-	-	✓	-	-	✓	-	-	✓	✓
Tobara dari Bone Talondo	✓	✓	✓		-	✓	-	-	✓	-	-	✓	✓	-
Bola Emas Burung Maleo	✓	-	-	-	-	✓	-	-	-	-	-	✓	✓	-
Legenda Putri Naga Komodo	✓	-	-	-	-	✓	-	-	-	-	-	✓	✓	✓
Asal Mula Pohon Kayu Putih	✓	-	-	-	-	✓	-	-	✓	-	-	-	✓	-
La Mellong	✓	-	-	-	-	✓	-	-	✓	-	-	-	✓	-
Patung Mbis dan Burung Kasuari	✓	-	-	-	✓	-	-	✓	-	-	✓	-	✓	-
Enggang dan Kasuari	✓	-	-	-	✓	-	-	✓	-	-	✓	-	-	-
Anjing Kili Bahe dan Kangguru	✓	-	✓	-	✓	-	-	-	-	-	✓	-	-	-
Asal Mula Pohon Sagu	✓	✓	-	-	✓	-	-	✓	-	-	✓	-	✓	-
Kakatua dan Taun-Taun	✓	-	-	-	✓	-	-	✓	-	-	✓	-	-	-

Where L1: Genetic Level Biodiversity and Factors Affecting It; L2: Species Level Biodiversity; L3: Ecosystem Level Biodiversity and the Uniqueness of Tropical Rainforests; D1: Distribution Area of Flora and Fauna of Western Indonesia (Asiatic); D2: Distribution Area of Flora and Fauna of Eastern Indonesia (Australic); D3: Distribution Area of Transitional Flora and Fauna (Wallacea); C1: Asiatic Flora Characteristics; C2: Australic Flora Characteristics; C3: Transitional Flora Characteristics; C4: Asiatic Fauna Characteristics; C5: Australic Fauna Characteristics; C6: Transitional Fauna Characteristics; B: Benefits of Biodiversity for Human Life; and T: Threats and Efforts to Preserve Biodiversity.

Based on Table 4, each folklore has its characteristics in containing content related to biodiversity sub-materials and no folklore contains content related to the material as a whole. As in the Batu Gajah folklore, which can be used as a learning resource in L1, its use is intended to provide examples of biodiversity at the genetic level, not to explain the factors that influence genetic diversity. This shows that it is not possible to determine only one folklore as a source of biodiversity learning to cover all the contents of the sub-material. This limitation is due to the characteristics of folklore itself as a learning resource *by utilization* whose creation is not specifically designed to learn biology. Therefore, in its use as a learning resource for biodiversity, some folklore needs to be combined and integrated with other learning resources.

Integration of folklore with other learning resources

The use of folklore as a learning resource cannot "run alone" so it needs to be integrated with other learning resources. Innovation of learning resources, especially with basic knowledge of local wisdom, can be packaged in the form of POBATEL, namely *Pesan* (messages), *Orang* (people), *Bahan* (materials), *Alat* (device), *Teknik* (techniques), and *Lingkungan* (setting) (Alimah, 2019; Sugiarto, 2017). The Association for Educational, Communication, and Technology (AECT) classifies learning resources into six types namely: (1) Message, information or teachings that are passed on by other components in the form of ideas, facts, meanings and data. Included in the message group are all fields of study or learning materials taught to students, etc. (2) People, humans who act as storage, processors and presenters of messages, which includes teachers, tutors, students, etc. (3) Materials, software that contains messages to be presented through the use of tools or hardware or by itself. Various media programs include material categories such as films, videos, modules, magazines, books, programmed learning materials,

transparencies, etc. (4) Device, hardware that is used to convey messages stored in the material, for example, overhead projectors, slides, videotapes/recorders, radio/TV sets, etc. (5) Technique, a procedure or reference for the use of materials, people and the learning environment in a combined and coordinated manner to convey teachings or subject matter. For example, learning independently, studying in groups, simulations, lectures, demonstrations, questions and answers, CBSA (active learning method), etc. (6) Setting, the situation or atmosphere around the teaching and learning process that occurs in the physical environment such as classrooms, buildings, schools, libraries, laboratories, parks, etc. as well as non-physical environments such as the learning atmosphere itself, quiet, crowded, etc. (Hidayati, 2019; Ikawati et al., 2018; Rohani, 2010).

Based on the classification of learning resources described, folklore is included in learning resources in the form of messages and contains various types of information, the background of the place and living things, as well as messages of life and conservation that can be used by students in studying biodiversity. In accordance with the learning objectives, the use of folklore in biodiversity learning needs to be combined with six kinds of learning resources such as messages (learning materials in books, information on the internet), people (teachers, peers, and other informants), teaching materials (textbooks, student worksheets, videos, etc.), learning tools/devices (laptops, projectors, whiteboards), learning models (Discovery Learning, Project Based Learning, Problem-Based Learning, etc.) and learning environments (in classrooms, school gardens, library, etc.).

Several aspects must be considered when using a learning resource, namely the efficiency of its use in assisting the learning process, how to enrich learning resources, and how to check the efficiency of these learning resources. Therefore, to determine the efficiency, as well as the feasibility and effectiveness of local wisdom innovation products as learning resources, it is necessary to conduct development research with different models according to the characteristics of the products (Alimah, 2019; Geladze, 2015).

The potential of folklore in developing student competencies

Previous studies have revealed the potential of folklore as a form of local wisdom, especially from Indonesia, in developing the self-competence of its readers as follows: (1) The life of the Dayak Paser and Berau people who are inseparable from the surrounding ecology is recorded in their folk stories, as evidenced by the emergence of distinctive terms or vocabulary that refers to the existence of flora, fauna, and concepts or traditions that strengthen the message of the story, namely, the importance of a harmonious relationship between humans and the surrounding ecology. In addition, local wisdom values in the story are also related to the treatment of ecology in fulfilling human needs, and how to process existing resources and protect them which appear in taboos or punishments for violating them which gradually become a myth (Amanat, 2019). (2) Biology learning which is integrated with local wisdom explores the potential of thinking, trains and familiarises students to perform problem-solving activities that originate from local wisdom. Learning biology with problem-solving activities based on local wisdom activates the cognitive structure of students to critically analyse problems that occur in their surroundings and creatively find solutions to problems based on these values contained in local wisdom which are used as learning resources (Alimah, 2019). (3) Folklore on Pisang Island mandates a prohibition against killing or destroying flora and fauna (such as ketapang trees, rengas, stingrays, turtledoves, black eagles, owls and great egrets), prohibition of activities in certain months, sacred tombs, and the daughter of the well, thus showing that indirectly, folklore plays a role in supporting environmental conservation because the community continues to preserve the environment by following the mandate or advice (Rawanda et al., 2020). (4) The form of ecological wisdom in Papuan folklore can be used as a guide, namely the habits of the people who regard the forest as their second home because these people's lives depend on the natural environment. The ecological reinforcement in Papuan folklore needs to be popularised throughout the archipelago to raise awareness of the importance of coexisting with their natural environment (Rahman & Purwanto, 2021). (5) Reading folklore can trigger children's creativity to hone their imagination. From folklore, children are used to visualizing many things and their thoughts, they can imagine anything that is not found in everyday life, thus the brain will imagine things that have never been seen but according to the child's creativity. Creativity developed after reading a story is not just knowing information about the story contents but children can use the story as creative material (Afriyanti et al., 2020).

From these five studies, the information obtained from folklore has the potential to develop student competencies in the form of caring for the environment, creative thinking skills, critical thinking, and problem-solving. However, the existence of folklore in this modern era is rare, especially folklore from remote areas in Indonesia. In this modern era with today's sophisticated and capable technology, much folklore has been abandoned or almost forgotten. Given the importance of an ancestral heritage that provides a cultural value in folklore, it is appropriate for today's young generation to continue to maintain, search for and revive parts of Indonesian folklore so that they will not be forgotten (Almiranti et al., 2021; Syuhada et al., 2018).

Conclusion

Folklore can potentially be used as a learning resource for biodiversity, as it contains content that can be used to study examples of the level of biodiversity, the distribution of biodiversity, the flora and fauna

characteristics of the Asiatic/Oriental, Australian, and Transitional, the benefits of biodiversity and its conservation efforts. The content in folklore as a learning resource by utilization cannot describe the overall material on biodiversity, therefore the use of folklore as a learning resource needs to be combined with other learning resources such as textbooks, the internet, etc. Furthermore, folklore as a source of learning also has the potential to develop student competencies, such as an attitude of caring for the environment, creative thinking skills, critical thinking, and problem-solving. However, the potential of folklore as a source of learning needs to be disclosed in other biology materials to increase the validity of these potentials and the innovation of folklore as a source of learning about biodiversity must be performed through development research so that its potential can be applied directly in learning in schools.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

R. M. D. Karmadi: Data analysis, Writing – original draft, Writing – review and editing. **S. Suhartini:** Methodology; Writing – original draft. **A. A. M. Sukri:** Writing – review and editing.

References

Adlina, Z., & Syahlan. (2019). A new proposed strategy for conflict resolution: A local wisdom exploration. *International Journal of Humanities and Social Development Research*, *3*(2), 74–82. https://doi.org/10.30546/2523-4331.2019.3.2.74

Afriyanti, I., Somadayo, S., & Hadi, D. (2020). Pemanfaatan media cerita rakyat sebagai upaya membangun kreativitas anak. *Jurnal Pedagogik*, *7*(2), 1–12. https://ejournal.unkhair.ac.id/index.php/pedagigk/article/download/2684/1813

Alimah, S. (2019). Kearifan lokal dalam inovasi pembelajaran biologi: strategi membangun anak indonesia yang literate dan berkarakter untuk konservasi alam. *Jurnal Pendidikan Hayati*, *5*(1), 1–9. https://doi.org/10.33654/jph.v5i1.574

Almiranti, S., Rachmayanti, I., & Wulandari, A. A. A. (2021). Interior design of Indonesia tale museum. *IOP Conference Series: Earth and Environmental Science*, *729*(1), 1–8. https://doi.org/10.1088/1755-1315/729/1/012076

Altwaiji, M. (2017). History of Saudi folklore and factors that shaped it. *Trames: Journal of the Humanities and Social Sciences*, *21*(2), 161–171. https://doi.org/10.3176/tr.2017.2.05

Amanat, T. (2019). Cerita rakyat Paser dan Berau dalam tinjauan ekologi sastra. *Kandai*, *15*(2), 145–166. https://doi.org/10.26499/jk.v15i2.956

Amlor, M. Q., & Alidza, M. Q. (2016). Indigenous education in environmental management and conservation in Ghana: The role of folklore. *Journal of Environment and Ecology*, *7*(1), 37–54. https://doi.org/10.5296/jee.v7i1.9705

Ardan, A. S. (2016). The development of biology teaching material based on the local wisdom of Timorese to improve students knowledge and attitude of environment in caring the persevation of environment. *International Journal of Higher Education*, *5*(3), 190–200. https://doi.org/10.5430/ijhe.v5n3p190

Asfar, D. A. (2014). *Asal Mula Rombok Manangar: Antologi Cerita Rakyat*. Pontianak: Balai Bahasa Provinsi Kalimantan Barat. https://123dok.com/document/zpxv0prq-asal-mula-rombok-manangar-antologi-cerita-rakyat.html

Asrif, A., & Hasan, N.H. (2019). Antologi Cerita Rakyat Pulau Buru. Maluku: Kerjasama Kantor Bahasa Maluku Badan Pengembangan Bahasa dan Perbukuan dengan De La Macca. https://repositori.kemdikbud.go.id/20875/1/Cerita-Rakyat-Pulau-Buru-Kezia-PDF.pdf

Asrif, A., & Kumbangsila, E.O. (2019). Antologi Cerita Rakyat Pulau Ambon dan Pulau-Pulau Lease. Maluku: Kerjasama Kantor Bahasa Maluku dengan Badan Pengembangan Bahasa dan Perbukuan Kementerian Pendidikan dan Kebudayaan. https://repositori.kemdikbud.go.id/25416/1/Antologi-Cerita-Rakyat-Pulau-Ambon-dan-Pulau-Pulau-Lease.pdf

Banda, D., & Morgan, W. J. (2013). Folklore as an instrument of education among the Chewa people of Zambia. *International Review of Education*, *59*(2), 197–216. https://doi.org/10.1007/s11159-013-9353-5

Biswas, S. (2018). Folk literature and environmental sustainability. *International Journal of Science and Research*, *8*(9), 1800–1803. https://doi.org/10.21275/ART20201526

Braverman, I. (2014). Conservation without nature: The trouble with in situ versus ex situ conservation. *Geoforum*, *51*, 47–57. https://doi.org/10.1016/j.geoforum.2013.09.018

Bunga, R. D., Rini, M. M., & Serlin, M. F. (2020). Peran cerita rakyat sebagai media pembelajaran bahasa Indonesia di kabupaten Ende. *Retorika*, *1*(1), 65–77. http://e-journal.uniflor.ac.id/index.php/RJPBSI/article/view/515

Crayn, D. M., Costion, C., & Harrington, M. G. (2015). The Sahul–Sunda floristic exchange: Dated molecular phylogenies document Cenozoic intercontinental dispersal dynamics. *Journal of Biogeography*, *42*(1), 11–24. https://doi.org/10.1111/jbi.12405

Dagba, B. I., Sambe, L. N., & Shomkegh, S. A. (2013). Totemic beliefs and biodiversity conservation among the Tiv people of Benue State, Nigeria. *Journal of Natural Sciences Research*, *3*(8), 145–149. https://www.iiste.org/Journals/index.php/JNSR/article/view/ 6919

Dewi, S. Z., & Ibrahim, H. T. (2019). Pentingnya pemahaman konsep untuk mengatasi miskonsepsi dalam materi belajar IPA di Sekolah Dasar. *Jurnal Pendidikan Universitas Garut*, *13*(1), 130–136. https://doi.org/http://dx.doi.org/10.52434/jp.v13i1.823

Dharmojo, D., & Jaruki, M. (2005). Antologi Cerita Binatang dari Tanah Papua. Jakarta: Pusat Bahasa Departemen Pendidikan Nasional. https://www.blibli.com/amp/p/antologi-cerita-binatang-daritanah-papua-dharmojo-dan-muhammad-jaruki-pusat-bahasa-jakarta-2005/ps--KAO-70140-07922

Erdmann, A.M. (2004). Panduan Sejarah Ekologi Taman Nasional Komodo. Jakarta: The Nature Conservancy Indonesia Coastal and Marine Program. https://pdf.usaid.gov/pdf_docs/Pnadh659.pdf

Fitriani, F., Sastromiharjo, A., Mulyati, Y., & Sumiyadi, S. (2020, November 20). The potentials of Malay folklore in West Kalimantan on learning writing short stories. *Proceedings of the First International Conference of Science, Engineering and Technology 2019*. https://doi.org/10.4108/eai.23-11-2019.2301479

Geladze, D. (2015). Using the internet and computer technologies in learning/teaching process. *Journal of Education and Practice*, *6*(2), 67–69. https://www.iiste.org/Journals/index.php/JEP/article/view/19402/19585

Hadijah, H., Nuddin, A., & Sriwahyuningsih, A. E. (2021). Penguatan kelembagaan pengelolaan kebun raya Masenrenpulu di Desa Batu Mila, Kecamatan Maiwa, Kabupaten Enrekang. *Jurnal Ilmiah Ecosystem*, *21*(3), 488–506. https://doi.org/10.35965/eco.v21i3.1140

Herlambang, A. E. N., Hadi, M., & Tarwotjo, U. (2016). Struktur komunitas capung di kawasan wisata Curug Lawe Benowo Ungaran Barat. *Bioma : Berkala Ilmiah Biologi*, *18*(1), 70–78. https://doi.org/10.14710/bioma.18.2.70-78

Hidayati, A. (2019). The analysis of influencing factors of learning styles, teacher's perceptions and the availability of learning resources in elementary schools in Padang, West Sumatra. *Journal of Physics: Conference Series*, *1185*(1), 1–3. https://doi.org/10.1088/1742-6596/1185/1/012149

Hodson, D. (2014). Learning science, learning about science, doing science: Different goals demand different learning methods. *International Journal of Science Education*, *36*(15), 2534–2553. https://doi.org/10.1080/09500693.2014.899722

Huang, R. (2015). Framework for a smart adult education environment. *World Transactions on Engineering and Technology Education*, *13*(4), 637–641. https://www.wiete.com.au/journals/WTE&TE/Pages/Vol.13,%20No.4%20(2015)/34-Huang-R.pdf

Ikawati, H. D., Purmadi, A., Anwar, Z., & Zulfakar, Z. (2018). Pengembangan media video permainan tradisional suku Sasak untuk pelestarian budaya dan sumber belajar muatan lokal. *JTP - Jurnal Teknologi Pendidikan*, *20*(3), 234–248. https://doi.org/10.21009/jtp.v20i3.9536

Irnaningtyas. (2016). *Biologi untuk SMA/MA kelas X*. Jakarta: Penerbit Erlangga

Janaki, M., Pandit, R., & Sharma, R. K. (2021). The role of traditional belief systems in conserving biological diversity in the Eastern Himalaya Eco-region of India. *Human Dimensions of Wildlife*, *26*(1), 13–30. https://doi.org/10.1080/10871209.2020.1781982

Jugli, S., Chakravorty, J., & Meyer-Rochow, V. B. (2020). Tangsa and Wancho of North-East India Use Animals not only as Food and Medicine but also as Additional Cultural Attributes. *Foods*, *9*(4), 1–29. https://doi.org/10.3390/foods9040528

Junaidi, J. (2019). Peran media pembelajaran dalam proses belajar mengajar. *Diklat Review: Jurnal Manajemen Pendidikan Dan Pelatihan*, *3*(1), 45–56. https://doi.org/10.35446/diklatreview.v3i1.349

Kemendikbud. (2016). *Silabus mata pelajaran biologi Sekolah Menengah Atas/Madrasah Aliyah (SMA/MA)*. http://sman1meukek.sch.id/home/download_file/35

Kilinc, A., Yeşiltaş, N. K., Kartal, T., Demiral, Ü., & Eroğlu, B. (2013). School students' conceptions about biodiversity loss: Definitions, reasons, results and solutions. *Research in Science Education*, *43*(6), 2277–2307. https://doi.org/10.1007/s11165-013-9355-0

Kurniawati, W., Puspita, D., Sugianto, G. (2016). Tobara dari Bone Talondo: Cerita Rakyat dari Sulawesi Barat. Jakarta: Badan Pengembangan dan Pembinaan Bahasa. https://opac.perpusnas.go.id/DetailOpac.aspx?id=1041657

Lidi, M. W., Daud, M. H., & Bolong, M. Y. M. (2021). Potensi kearifan lokal tambi uma suku Ende sebagai sumber belajar biologi dan pendidikan karakter. *Jurnal Pendidikan Biologi*, *12*(1), 45–51. https://doi.org/10.17977/um052v12i1p45-51

Maulina, Y. (2014). Cerita rakyat "Asal-Usul Pulau Halang": Analisis fungsi vladimir propp. *Madah*, *5*(1), 105–114. https://doi.org/10.26499/madah.v5i1.528

Michalopoulos, S., & Xue, M. M. (2021). Folklore. *The Quarterly Journal of Economics*, *136*(4), 1993–2046. https://doi.org/10.1093/qje/qjab003

Mndawe, I. K. (2019). Taboos as part of communal teaching on children safety and biodiversity sustainability. *Southern African Journal for Folklore Studies*, *29*(1), 1–14. https://doi.org/https://doi.org/10.25159/1016-8427/4837

Møller, A. P., Morelli, F., & Tryjanowski, P. (2017). Cuckoo folklore and human well-being: Cuckoo calls predict how long farmers live. *Ecological Indicators*, *72*, 766–768. https://doi.org/10.1016/j.ecolind.2016.09.006

Morrone, J. J. (2015). Biogeographical regionalisation of the world: A reappraisal. *Australian Systematic Botany*, *28*(3), 81–90. https://doi.org/10.1071/SB14042

Pamungkas, O. Y., Sudigdo, A., Fathonah, S., Fauzan, A., & Suroso, E. (2022). Representasi lingkungan dalam sastra Indonesia: Tinjauan literatur review. *Jurnal Kridatama Sains Dan Teknologi*, *4*(2), 230–239. https://doi.org/10.53863/kst.v4i02.598

Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 24 Tahun 2016 Tentang Kompetensi Inti dan Kompetensi Dasar Pelajaran Pendidikan Dasar dan Pendidikan Menengah. (n.d.). Retrieved January 30, 2023, from https://drive.google.com/file/d/0B18mXGGKnIqvaXU1cTltWVEzN0U/view?resourcekey=0-M2VoFQlbguYWgnBzfvoWXQ

Pornpimon, C., Wallapha, A., & Prayuth, C. (2014). Strategy challenges the local wisdom applications sustainability in schools. *Procedia - Social and Behavioral Sciences*, *112*, 626–634. https://doi.org/10.1016/j.sbspro.2014.01.1210

Pushpangadan, P., George, V., Parambil Ijinu, T., & Ambika Chithra, M. (2018). Biodiversity, bioprospecting, traditional knowledge, sustainable development and value added products: A review. *Journal of Traditional Medicine & Clinical Naturopathy*, *7*(1), 1–7. https://doi.org/10.4172/2573-4555.1000256

Rahayu, R. D., Setia, T. M., & Mangunjaya, F. (2021). Pemahaman keanekaragaman hayati pada guru dan penggunaan ruang terbuka hijau dalam pembelajaran keanekaragaman hayati. *BioEdUIN: Jurnal Program Studi Pendidikan Biologi*, *11*(2), 88–95. https://doi.org/10.15575/bioeduin.v11i2.14314

Rahman, H., & Purwanto, W. E. (2021). Bentuk kearifan ekologis Papua dalam cerita rakyat Papua. *Prosiding Seminar Bahasa Dan Sastra Indonesia*, *5*(1), 318–325. https://doi.org/10.22219/.v5i1.4912

Rambe, P., & Bere, A. (2013). Using mobile instant messaging to leverage learner participation and transform pedagogy at a South African University of Technology. *British Journal of Educational Technology*, *44*(4), 544–561. https://doi.org/10.1111/bjet.12057

Rawanda, R., Winarno, G. D., Febryano, I. G., & Harianto, S. P. (2020). Peran folklore dalam mendukung pelestarian lingkungan di Pulau Pisang. *Journal of Tropical Marine Science*, *3*(2), 74–82. https://doi.org/10.33019/jour.trop.mar.sci.v3i2.1915

Rawat, U. S., & Agarwal, N. K. (2015). Biodiversity: Concept, threats and conservation. *Environment Conservation Journal*, *16*(3), 19–28. https://doi.org/10.36953/ECJ.2015.16303

Rikarno, R. (2015). Film dokumenter sebagai sumber belajar siswa. *Ekspresi Seni*, *17*(1), 129–149. https://doi.org/10.26887/ekse.v17i1.71

Rohani, A. (2010). *Pengelolaan pengajaran: Suatu pengantar menuju guru professional*. Jakarta: PT. Rineka Cipta. https://inlislite.uin-suska.ac.id/opac/detail-opac?id=15867

Roy, B., Rahman, Md. H., & Fardusi, Most. J. (2013). Status, diversity, and traditional uses of homestead gardens in northern Bangladesh: A means of sustainable biodiversity conservation. *ISRN Biodiversity*, *2013*, 1–11. https://doi.org/10.1155/2013/124103

Sawijiningrum, W. (2018). Ekokritik Greg Garrard dalam novel Api Awan Asap karya Korrie Layun Rampan dan relevansi pembelajaran sastra di Sekolah Menengah Atas. *Matapena: Jurnal Keilmuan Bahasa*, *1*(2), 80–92. http://ejurnal.unim.ac.id/index.php/matapena/article/view/283

Setiawan, A. (2022). Keanekaragaman hayati Indonesia: Masalah dan upaya konservasinya. *Indonesian Journal of Conservation*, *11*(1), 13–21. https://doi.org/10.15294/ijc.v11i1.34532

Shah, S. A. H., Bilal, A., Ahmad, M. M., & Bukhari, S. S. (2022). Deforestation is causing a great loss in avian diversity in Pakistan. *American Journal of Zoology*, *5*(3), 24–29. https://doi.org/10.11648/j.ajz.20220503.11

Siemens, G. (2013). Learning analytics: The emergence of a discipline. *American Behavioral Scientist*, *57*(10), 1380–1400. https://doi.org/10.1177/0002764213498851

Singh, V., Shukla, S., & Singh, A. (2021). The principal factors responsible for biodiversity loss. *Open Journal of Plant Science*, *6*(1), 11–14. https://doi.org/10.17352/ojps.000026

Somad, A.A. (2007). Aktif dan Kreatif Berbahasa Indonesia untuk Kelas X SMA/MA. Bandung: Direktorat Pembinaan Sekolah Menengah Kejuruan. https://perpustakaan.gunungsitolikota.go.id/opac/detail-opac?id=252

Sriyati, S., Ivana, A., & Pryandoko, D. (2021). Pengembangan perangkat pembelajaran biologi berbasis potensi lokal dadiah untuk meningkatkan keterampilan proses sains siswa. *Jurnal Pendidikan Sains Indonesia*, *9*(2), 168–180. https://doi.org/10.24815/jpsi.v9i2.18783

Suarmika, P. E., Arnyana, I. B. P., Suarni, N. K., & Marhaeni, A. A. I. N. (2020). Indigenous science: What we can learn? (the exploration of Balinese local wisdom for science learning). *Journal of Physics: Conference Series*, *1567*(4), 1–6. https://doi.org/10.1088/1742-6596/1567/4/042016

Subiyakto, B., & Mutiani, M. (2019). Internalisasi nilai pendidikan melalui aktivitas masyarakat sebagai sumber belajar ilmu pengetahuan sosial. *Khazanah: Jurnal Studi Islam Dan Humaniora*, *17*(1), 137–166. https://doi.org/10.18592/khazanah.v17i1.2885

Subqi, I. (2016). Pemanfaatan pusat sumber belajar dalam meningkatkan hasil belajar. *Jurnal Teknologi Pendidikan*, *1*(1), 88–98. https://e-journal.undikma.ac.id/index.php/jtp/article/view/605/566

Suciyati, A., & Abrori, F. M. (2021). Development of biology learning comic based on the Tidung tribe's Gasab philosophy (an ethnoecological perspective of Yadu Usuk folklore study). *Advances in Social Science, Education and Humanities Research*, *619*, 5–10. https://doi.org/10.2991/assehr.k.211219.002

Sugiarto, E. (2017). Kearifan ekologis sebagai sumber belajar seni rupa: Kajian ekologi-seni di wilayah pesisir Semarang. *Jurnal Imajinasi*, *11*(2), 135–142. https://doi.org/10.15294/imajinasi.v11i2.12815

Suhirman, S. (2018). Pengelolaan sumber belajar dalam meningkatkan pemahaman peserta didik. *Al Fitrah: Journal Of Early Childhood Islamic Education*, *2*(1), 159–173. https://doi.org/10.29300/alfitrah.v2i1.1513

Supriadi, S. (2015). Pemanfaatan sumber belajar dalam proses pembelajaran. *Lantanida Journal*, *3*(20), 127–139. https://doi.org/10.22373/lj.v3i2.1654

Supriadi, S. (2017). Pemanfaatan Sumber Belajar Dalam Proses Pembelajaran. *Lantanida Journal*, *3*(2), 127. https://doi.org/10.22373/lj.v3i2.1654

Syuhada, Murtadlo, A., & Rokhmansyah, A. (2018). Nilai dalam cerita rakyat suku Dayak Tunjung Tulur Aji Jangkat di Kutai Barat: Kajian folklor. *Jurnal Ilmu Budaya*, *2*(2), 188–195. https://doi.org/10.30872/jbssb.v2i2.1093

Tejokusumo, B. (2014). Dinamika masyarakat sebagai sumber belajar ilmu pengetahuan sosial. *Geoedukasi: Jurnal Penelitian Dan Pengembangan Geografi*, *3*(1), 38–43. https://jurnalnasional.ump.ac.id/index.php/GeoEdukasi/article/view/588

Tim Penelitian dan Pencatatan Kebudayaan Daerah Provinsi Sulawesi Selatan. (1977). Cerita Rakyat Daerah Sulawesi Selatan. Sulawesi Selatan: Proyek Pengembangan Media Kebudayaan. https://repositori.kemdikbud.go.id/8245/1/CERITERA%20RAKYAT%20DAERAH%20SULAWESI%20SELATAN.pdf

Tim Proyek Penelitian dan Pencatatan Daerah. (1978). Cerita Rakyat Daerah Jawa Timur. Jakarta: Proyek Penerbitan Buku Bacaan dan Sastra Indonesia dan Daerah. https://repositori.kemdikbud.go.id/8175/1/CERITA%20RAKYAT%20DAERAH%20JAWA%20TIMUR.pdf

Verma, A. K. (2016). Biodiversity: Its different levels and values. *International Journal on Environmental Sciences*, *7*(2), 143–145. https://www.researchgate.net/publication/342638063

Widjaja, E. A., Rahayuningsih, Y., Rahajoe, S. J., Ubaidillah, R., Maryanto, I., Walujo, E. B., & Semiadi, G. (2014). *Kekinian keanekaragaman hayati Indonesia 2014*. http://penerbit.lipi.go.id/data /naskah1432194926.pdf

Widodo, S. (2010). 10 cerita rakyat Papua terpilih. Jakarta: Kerjasama Balai Bahasa Jayapura Kementrian Pendidikan Nasioanl dengan CV. Prasasti. https://repositori.kemdikbud.go.id/3558/1/Sepuluh%20Cerita%20Rakyat%20Papua%20Terpilih.pdf

Wulandari, F. (2020). Pemanfaatan lingkungan sebagai sumber belajar anak Sekolah Dasar (kajian literatur). *Journal of Educational Review and Research*, *3*(2), 105–110. https://doi.org/10.26737/jerr.v3i2.2158

Wulansari, K., Intan Rahmadhani, D., Aisyah Putri, N., Wahyuni, S., Razak, A., & Arsih, F. (2022). Analisis kearifan lokal keripik Sanjai di kota Bukittinggi sebagai sumber belajar biologi materi keanekaragaman hayati. *Symbiotic: Journal of Biological Education and Science*, *3*(2), 71–76. https://doi.org/10.32939/symbiotic.v3i2.58

Yustika, N. W. S. (2017). Pentingnya sarana pendidikan dalam menunjang kualitas pendidikan di sekolah. *Guna Widya: Jurnal Pendidikan Hindu*, *4*(2), 1–12. http://ejournal.ihdn.ac.id/index.php/GW/article/view/1053/902