



Mapping Biological Concepts in Bugis Folklore: Implications for Contextual Biology Education

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ABSTRACT

Folklore is more than a collection of cultural stories; it also preserves knowledge that communities have accumulated across generations. In biology education, however, scientific concepts are often taught apart from students' cultural experience, creating a need for locally meaningful contexts. This conceptual literature review maps biological concepts across six forms of Bugis folklore and traditional knowledge from South Sulawesi, Indonesia: the *I La Galigo* epic and Sawerigading myth, the *Mappacci* ritual, the *siri' na pacce* philosophy, Sawerigading rice traditions, narratives of forests and sacred springs, and traditional medicinal knowledge (ethnobotany). The study combines a conceptual literature review, thematic content analysis, and limited cultural observation. Sources were identified through Google Scholar, ERIC, Semantic Scholar, and related academic outlets, while observation was used to document selected cultural materials and biological objects associated with Bugis traditions. The mapping identifies connections with genetics and kinship, plant morphology and phytochemistry, insect metamorphosis, fruit anatomy, domestication and breeding, ecology, conservation, and ethnobotany. Rather than treating these cultural elements as isolated examples, the study brings them together in an integrative framework aligned with major biology curriculum domains. The analysis suggests that Bugis folklore is an underused ethnoscience resource for contextual biology education. It may inform Contextual Teaching and Learning (CTL), technology-assisted learning, and other culturally grounded approaches, provided that symbolic meanings are kept analytically distinct from scientific evidence. The framework is intended for curriculum design and still requires cultural validation and classroom-based testing before claims of instructional effectiveness can be made.

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I. INTRODUCTION

Across cultures, folklore has often carried observations about the natural world alongside narrative meaning. [Nakawake and Sato \(2019\)](#), for example, used natural language processing on 382 animal folktales and found that animal pairings in stories frequently paralleled real predator-prey relationships, including cat-mouse and wolf-pig pairings; antagonistic motifs were also more common in tales about wild animals. Findings of this kind suggest that folklore can preserve empirically grounded knowledge in culturally recognizable forms. The Bugis tradition of South Sulawesi offers a useful setting in which to examine that possibility.

Bugis cultural life includes narratives associated with I La Galigo and Sawerigading, the *Mappacci* ritual, the ethical philosophy of *siri'na pacce*, and shorter folk stories that continue to circulate in community and educational settings ([HMZ, 2022](#)). Scholarship has generally approached these materials through literature learning, character education, and cultural preservation because of their symbolic and moral content ([HMZ, 2022](#)). Yet they also contain objects, practices, and relationships that invite biological interpretation. Studies of *Mappacci*, for instance, document the use of henna, jackfruit, banana, rice, coconut, palm, and cotton, while recent work in digital biology learning links *Mappacci* symbols with topics such as plant ecology and life cycles ([Rijal et al., 2024](#); [Veryani et al., 2025](#)). Seen from this perspective, Bugis folklore is not only a literary or cultural resource; it can also provide locally meaningful entry points into biology.

One reason this matters is the persistent distance between school biology and students' everyday worlds. Biology is often experienced as abstract, especially when concepts such as inheritance, life cycles of organisms, ecological interactions, and biodiversity are presented through generic textbook examples rather than familiar settings ([Arifin et al., 2026](#); [Hasanah et al., 2025](#)). That distance can encourage students to treat the subject as a body of facts to memorize rather than as a way to interpret the living systems around them ([Arifin et al., 2026](#)). [Çimer \(2012\)](#) reported a similar pattern among secondary school students in Turkey, where difficulty in biology was associated with abstract content, teacher-centered instruction, and weak links between classroom material and everyday experience. These findings make a strong case for contexts that are practical, visual, and culturally recognizable.

Bringing indigenous knowledge into science education has therefore become a wider international concern, not simply a local curriculum preference ([Saleng et al., 2025](#)). A systematic review by [Rasmawan et al. \(2025\)](#) reported benefits for students' appreciation of nature and biodiversity, cultural awareness, thinking skills, content mastery, and motivation, while [da Silva et al. \(2024\)](#) noted that integration across formal schooling is growing even as

curricular and pedagogical challenges remain. Indonesian curriculum policy is broadly compatible with this direction. *Kurikulum Merdeka* emphasizes essential content, flexibility, and contextual learning, leaving room for regional and cultural material to be incorporated where it supports curriculum goals. For biology educators, that opens space to use local wisdom as part of the learning resource base rather than as peripheral enrichment.

Recent Bugis-focused work already points in this direction. [Veryani et al. \(2025\)](#) explored *Mappacci* symbols in augmented-reality-based biology learning, showing how a local cultural practice can become a contextual resource for science education. The idea also fits [Berkes's \(2018\)](#) account of traditional ecological knowledge as a cumulative, place-based body of knowledge, practice, and belief concerning relationships among living beings, ecosystems, and communities. Reviews of indigenous knowledge and ethnoscience in science education likewise describe applications through cultural practices, fieldwork, digital media, and learning modules, with reported benefits for conceptual understanding, cultural awareness, motivation, and conservation-oriented values ([Rasmawan et al., 2025](#); [Sarwi et al., 2025](#)).

Even with this growing literature, the educational links have mostly been developed one tradition or material at a time. A broader map connecting Bugis epics, rituals, agrarian myths, ethical philosophy, folk narratives, and traditional medicinal knowledge to core biology topics is still lacking. The gap is important because these cultural domains span several levels of biological organization: *I La Galigo* foregrounds kinship; *Mappacci* brings plants, fruits, and insects into view; rice traditions raise questions of crop variation; and ecological narratives concern populations, communities, and conservation. The point is not to create a separate "local wisdom" topic. Rather, culturally familiar material can be used where the curriculum already addresses heredity, plant structure, biodiversity, ecological interaction, or resource use, so that local context strengthens rather than displaces biological learning outcomes.

This article develops such an integrative mapping and treats Bugis folklore as an ethnoscience-based resource for contextual biology learning. The approach requires a clear epistemic boundary. Cultural narratives, ritual meanings, and customary prohibitions can identify which questions matter within a community and provide meaningful context for learning, but they are not substitutes for biological evidence. In the mapping used here, cultural elements serve as entry points, while biological explanations draw on established concepts and supporting scholarship. This distinction allows Bugis knowledge to be taken seriously without reducing it to decorative context or using it to support claims beyond the available evidence. Three questions guide the study: (1) Which biological concepts are embedded in major forms of Bugis folklore and tradition? (2) How do these concepts align with core topics in the biology

curriculum? and (3) How can the mapping be used pedagogically while maintaining a clear distinction between symbolic cultural meaning and scientific evidence?

II. METHODS

The study used a qualitative descriptive design that combined a conceptual literature review, limited cultural observation, and thematic content analysis. Each component served a different purpose: the literature review brought together cultural, biological, and educational sources, while observation provided contextual support for interpreting selected ritual objects, symbols, and biological materials associated with Bugis traditions (Snyder, 2019). The analysis followed four stages: literature search and selection, limited cultural observation, thematic content analysis, and auditable conceptual mapping, as shown in Figure 1. Working through these stages made it possible to compare cultural and biological evidence before assigning curriculum-relevant categories, rather than relying on a single source to carry the entire interpretive link.

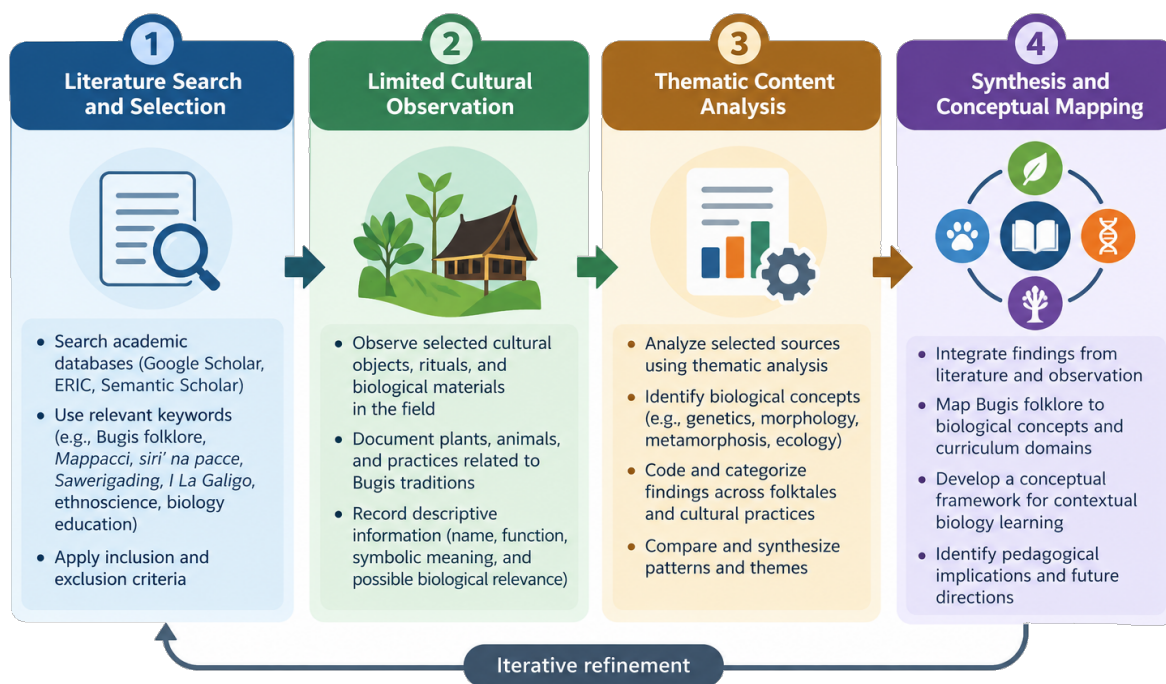


Figure 1. Four-stage procedure for mapping Bugis folklore to biological concepts

Sources were gathered from Google Scholar, ERIC, Semantic Scholar, ResearchGate, Garuda, and institutional Open Journal Systems (OJS). Search terms combined Bugis cultural expressions with science education concepts, including Bugis folklore, *Mappacci*, *siri' na pacce*, *Sawerigading*, *I La Galigo*, ethnoscience, Bugis ethnobotany, and indigenous knowledge in science education. The corpus included journal articles, theses, curriculum documents, and scientific publications relevant to the biological or phytochemical properties of cultural objects

identified in the folklore. Limited cultural observation complemented the literature review. It focused on selected objects, ritual attributes, and biological materials associated with Bugis traditions, particularly *Mappacci* and related folklore-based practices. A simple protocol recorded four features: the object or material, its cultural function, its symbolic meaning, and its possible biological relevance. Keeping these fields separate at the point of observation helped prevent symbolic interpretation from being conflated with biological identity or function. Field notes and visual documentation recorded observable features such as plant parts, ritual arrangements, material use, and contextual meaning. These observations were used only to support interpretation and were not intended as a basis for ethnographic generalization.

Thematic content analysis was then used to identify recurring folklore elements, biological objects or phenomena, and their relationship to biology curriculum topics. Following [Clarke and Braun \(2017\)](#), the analysis treated themes as patterns developed through systematic engagement with the source material. An initial set of categories was generated during the first pass through the literature and revised as additional sources were examined. Categories were combined or separated when necessary until six groups captured the material without substantial overlap in their primary biological focus. The final mapping linked each cultural element to a biological concept, a curriculum domain, and the source that supported the connection.

The study did not include interviews, classroom implementation, or biological laboratory testing. Its evidence came from published literature and limited cultural observation, so the resulting map should be read as an interpretive conceptual synthesis rather than as an empirical test of instructional effectiveness ([Creswell & Poth, 2018](#)). The term observation is used narrowly here: it refers to the examination of visible cultural materials, particularly ritual plants and objects, and not to a full ethnographic study. No learning outcomes were measured, and no laboratory assays were conducted. The tables therefore represent an evidence-informed curriculum map, not a biological inventory of Bugis culture. Future work can test individual links through cultural consultation, botanical identification, classroom implementation, or learning assessment.

For auditability, the cultural element, biological phenomenon, curriculum topic, and supporting source were treated as separate analytical units. A connection was retained only when the cultural element could be traced to a published cultural or ethnographic source and its proposed biological relevance could be explained through an identifiable biology or science-education source. Analogical links were labeled as such. The social solidarity expressed in *siri' na pacce*, for example, may support discussion of ecological interdependence, but it does not

establish a biological mechanism. This separation reduces the risk of turning cultural values into empirical biological claims and makes the intended instructional use of each connection explicit (Clarke & Braun, 2017; Snyder, 2019). It also allows later researchers to revise or challenge individual links without discarding the framework as a whole.

III. RESULTS

Six recurring cultural domains emerged from the analysis, spanning biological ideas at the organism, population, ecosystem, and resource-use levels. The sections that follow examine each category in turn and show how the cultural material can be connected to curriculum concepts without treating the cultural account itself as scientific evidence.

1. I La Galigo and Sawerigading narratives: kinship, reproduction, and the incest taboo

I La Galigo or Sureq Galigo is a pre-Islamic Bugis mythological epic recognized by UNESCO's Memory of the World program in 2011. Its account of Bugis origins centers on figures including Batara Guru, Sawerigading, and La Galigo. In one episode, Sawerigading, the son of Batara Lattu', is separated from his twin sister, We Tenriabeng, because an incestuous relationship is portrayed as a taboo that could bring disaster to the kingdom. He later travels to Cina/Senrijawa and marries We Cudai, from whom La Galigo is born. The genealogy structures the epic's dynastic narrative while also reflecting Bugis ideas of kinship, marriage, and political legitimacy (UNESCO, 2011; Komite Nasional Memory of the World Indonesia, 2011; Akhmad et al., 2018). For biology teaching, the genealogy offers a culturally familiar starting point for discussing genetic relatedness, reproduction, inheritance, and the biological implications of close-kin marriage.

The educational value lies in the sequence of questions the narrative can open. Students may begin by reconstructing the genealogy and identifying patterns of relatedness, then ask why close-kin marriage is discouraged in many societies. The lesson can subsequently move to allele inheritance, heterozygosity, homozygosity, and genetic diversity. Used in this way, the epic is not treated as a genetic case record; it activates cultural knowledge, while the biology lesson supplies the evidence, terminology, and model-based reasoning needed to explain population-level consequences. That distinction is especially important for a sensitive topic, because genetic inference cannot be drawn from mythic genealogy alone.

Table 1 brings these connections together by pairing the main Sawerigading narrative elements with relevant biological concepts and their possible use in contextual biology learning.

Table 1. Mapping of biological concepts in the Sawerigading narrative

Narrative element	Biological concept	Biology-learning relevance	Supporting source
Birth narrative of Sawerigading and We Tenriabeng	Monozygotic and dizygotic twins; genetic variation	Introduces inheritance and genetic variation through a culturally familiar narrative context.	Hall (2003)
Incest taboo between Sawerigading and We Tenriabeng	Inbreeding, homozygosity, deleterious recessive alleles, and inbreeding depression	Links a cultural prohibition to introductory population genetics and the importance of genetic diversity.	Bittles (2008)
Genealogical structure in I La Galigo	Pedigree and inheritance patterns	Provides an illustrative context for explaining kinship diagrams, while remaining a conceptual rather than empirical genetic example.	Akhmad et al. (2018)

2. *Mappacci* ritual: plant morphology, phytochemistry, and insect biology

The term *Mappacci* derives from *paccing*, meaning "clean" or "pure," and refers to a self-purification procession held before a Bugis wedding ceremony (*tudang penni*). During the central part of the ritual, relatives and community figures place henna or *pacci* leaves on the palms of the bride or groom as a sign of blessing and prayer, after which rice is scattered ([Pratama et al., 2026](#)).

Several materials used in *Mappacci* are simultaneously cultural symbols and biological objects that can be examined in a biology lesson. They include *pacci* or henna leaves (*Lawsonia inermis*), jackfruit leaves (*Artocarpus heterophyllus*), coconut (*Cocos nucifera*), rice grains (*Oryza sativa*), and silk cloth produced from silkworm cocoons (*Bombyx mori*). Table 2 summarizes the observable biological features and the curriculum connections that can be drawn from them.

Table 2. Limited observation of biological materials in the *Mappacci* ritual

Observed object/material	Cultural function or symbolic meaning	Observable biological feature	Possible biology-learning connection
<i>Pacci</i> /henna leaves (<i>Lawsonia inermis</i>)	Used as a symbol of purity, blessing, and self-cleansing before marriage.	Leaf pigmentation and plant-derived dye that stains the skin and nails.	Plant secondary metabolites, phytochemistry, and traditional plant use.
Jackfruit leaves (<i>Artocarpus heterophyllus</i>)	Placed as part of ritual arrangements and associated with prosperity and good hopes.	Leaf morphology, texture, and plant tissue structure.	Plant morphology, phytochemical screening, and local plant knowledge.

Observed object/material	Cultural function or symbolic meaning	Observable biological feature	Possible biology-learning connection
Rice grains (<i>Oryza sativa</i>)	Scattered as a symbol of blessing, fertility, and prosperity.	Seed or grain structure and cereal crop characteristics.	Seed biology, cereal crops, plant reproduction, and food resources.
Coconut (<i>Cocos nucifera</i>)	Represents completeness, usefulness, and continuity of life.	Fibrous fruit layers, hard endocarp, germination pores, and endosperm.	Fruit anatomy, monocot seed structure, and plant adaptation.
Silk cloth/ <i>lipa' sabbe</i>	Used as a ritual textile and marker of cultural identity.	Derived from silk threads produced by silkworm cocoons.	Insect metamorphosis, cocoon formation, and sericulture.

Therefore, observations and the literature point to several biological entry points within *Mappacci*. Pacci leaves (*Lawsonia inermis*) and jackfruit leaves (*Artocarpus heterophyllus*), for example, can support discussion of plant morphology, phytochemistry, and secondary metabolites. *Lawsonia inermis* contains lawsone, the naphthoquinone responsible for the reddish-brown stain on skin and nails, and has also been reported to contain phenolic and flavonoid compounds associated with antioxidant, antimicrobial, anti-inflammatory, and wound-healing activities (Joshi et al., 2025). *Artocarpus heterophyllus* leaves likewise contain phytochemical constituents such as flavonoids and phenolic compounds and have shown antimicrobial potential, making them useful for introducing phytochemical screening and the functions of plant secondary metabolites (Sivagnanasundaram & Karunanayake, 2015).

The biological possibilities extend beyond phytochemistry. Coconut (*Cocos nucifera*) provides a familiar specimen for examining monocot fruit and seed anatomy, including the fibrous mesocarp, hard endocarp, germination pores, and endosperm development (Beveridge et al., 2022). Silk cloth, or *lipa' sabbe*, opens a different line of inquiry through the life cycle of the domesticated silkworm (*Bombyx mori*), including complete metamorphosis, cocoon formation, and sericulture (Goldsmith et al., 2005). Together, these materials connect a single ritual with botany, plant biochemistry, fruit anatomy, and entomology.

Mappacci also lends itself to inquiry because many of its materials can be observed directly or through high-quality images and specimens. Learners can compare leaf form, describe fruit layers, identify stored food tissue in a seed, or sequence the stages of complete metamorphosis before introducing formal terminology. Questions about *pacci* or other plants can then distinguish a culturally valued use from a biological claim about chemical constituents or therapeutic effects. The ritual remains culturally meaningful, but the biology task stays grounded in observation, classification, evidence, and the limits of inference. This use is

consistent with recent work on digital and augmented-reality biology learning based on *Mappacci* (Rijal et al., 2024; Veryani et al., 2025).

3. Sawerigading rice: food security, domestication, and plant breeding

Padi (rice) Sawerigading sits at the intersection of cultural identity, traditional agriculture, and crop biodiversity in South Sulawesi. In Luwu Regency, several local rice varieties carry the name Sawerigading, linking agricultural memory with the prominent figure of I La Galigo. Mongabay Indonesia documented at least three locally recognized varieties: *lotong sawerigading*, *ta'daga sawerigading*, and *nippon sawerigading*. The account drew on interviews with Saghir Sama, a rice researcher and former head of the Sulawesi Plant Protection Center who had studied rice since 1958, and described the gradual replacement of these varieties by shorter-duration, high-yield national varieties (Saturi, 2015). Related varieties have also been reported in Suli, Larompong, and Welenrang, where some continue to be maintained through intergenerational seed preservation (Buana, 2021).

For biology education, the cultural history of Sawerigading rice creates a concrete context for crop domestication, intraspecific variation, plant breeding, and the conservation of genetic resources. Population-genetic research shows that the domestication of rice from its wild relative, *Oryza rufipogon*, involved selection for traits such as seed shattering and dormancy, resulting in cultivated varieties with diverse agronomic characteristics (Kovach et al., 2007). This scientific background helps explain why locally maintained rice diversity can be discussed in relation to broader processes of selection and crop change.

The example also makes agrobiodiversity easier to discuss without implying that the local varieties examined here have been genetically characterized. Students can distinguish a culturally named variety from a landrace or a genetically described cultivar, then consider how selection for harvest time, grain traits, resistance, or local adaptation may generate variation within *Oryza sativa*. The cultural history of Sawerigading rice thus becomes a prompt for studying domestication, selection, germplasm conservation, and the relationship between agricultural choices and biodiversity (Kovach et al., 2007).

4. The philosophy of *siri' na pacce*: ecological perspectives and interdependence

Siri' na pacce is a Bugis-Makassar ethical philosophy centered on dignity, compassion, and social solidarity. *Siri* refers to the defense of honor and self-respect, whereas *pacce* conveys shared suffering and compassionate responsibility toward others. In biology education, this philosophy is useful not because it explains ecological mechanisms, but because it provides a culturally familiar language for discussing interdependence. Arifin et al. (2026) reported that students

connected *siri' na pacce* with ecological ideas and that its use in biology learning was associated with engagement, conceptual understanding, ecological awareness, and social responsibility.

Two ecological ideas are especially useful for making this analogy explicit:

a. Interdependence and symbiosis.

Mutual support within a community, as represented by *pacce*, can be used as an analogy for mutualism in ecology. The comparison is deliberately limited: *pacce* expresses a social ethic of solidarity, whereas mutualism describes a biological interaction whose effects can be observed and measured. Used in this way, the analogy can introduce the idea of interdependence without treating a cultural value as a biological mechanism.

b. Community and ecosystem stability

The same cultural value can also open discussion about community and ecosystem stability. Social practices that sustain relationships among people provide an accessible analogy for feedback and interdependence in ecological systems. In class, *siri' na pacce* can therefore serve as a context for examining organism interactions, system balance, and human-environment relationships, provided that the analogy is not mistaken for a biological explanation.

The boundary between analogy and mechanism needs to remain explicit. *Pacce* describes a moral orientation toward shared suffering and responsibility; mutualism, competition, predation, and nutrient cycling describe biological relationships under specific ecological conditions. The cultural value can nevertheless help learners ask why ecological systems depend on relationships, what happens when one component is disrupted, and why environmental decisions have social consequences. Framed this way, *siri' na pacce* is not biologized, and ecology is not reduced to a moral metaphor. Instead, the two are brought into dialogue around interdependence and stewardship (Arifin et al., 2026).

5. Bugis folk narratives of sacred forests and springs: ecosystems, biodiversity, and conservation

Bugis folk narratives such as *Ikan di Sungai Bajoe*, *Orang Gila*, and *Hikayat Mata Air Keramat* carry environmental themes related to forests, water, and resource use (Juanda, 2023). Many of these stories connect traditional prohibitions (*pemali*) with the protection of springs, forests, and fish populations, reflecting local ecological reasoning about human relationships with the environment. Ethnographic research in Cerekang, South Sulawesi, provides a related example: community knowledge and forest-protection taboos (*pammali*) are embedded in a mythological landscape associated with La Galigo, showing how Bugis cosmology and conservation practice have become historically intertwined (Akhmar et al., 2023).

Two examples illustrate how these narratives can be brought into biology learning:

a. River ecosystems and catchment areas

Narratives about sacred springs reflect an understanding that changes in upstream forest conditions can affect water availability and the survival of organisms downstream.

b. Species conservation and resource management

Traditional restrictions on excessive fishing or wildlife exploitation can be linked to ecological principles of sustainable resource management and population conservation.

These narratives can therefore support locally grounded work on ecosystems, biodiversity conservation, and the effects of human activity. A story about a sacred spring or forest, for example, can lead into a socio-ecological investigation in which learners map a catchment, identify organisms that depend on water availability, consider the consequences of vegetation loss upstream, and compare customary restrictions with contemporary conservation principles. The purpose is not to test the literal truth of the story. Rather, the lesson examines how narrative can carry place-based memory, restraint, and environmental responsibility. Research in Cerekang similarly shows that forest-protection taboos and traditional ecological knowledge are embedded in a La Galigo-related cultural landscape ([Akhmar et al., 2023](#)), supporting the use of folklore as a context for conservation reasoning rather than as literary content alone.

6. Traditional medicine (ethnobotany): biodiversity, plant knowledge, and ethnopharmacology

Traditional medicinal knowledge forms the sixth category in the mapping. The literature reviewed includes an ethnosciences-based e-module organized around the diversity of medicinal plants used within the Bugis community, showing how locally documented plant knowledge can be connected with species diversity and formal biology content ([Apriansyah et al., 2024](#)). In Table 3, this category is linked with biodiversity, plant physiology, pharmacognosy, and ethnopharmacology. Its curricular value lies in using traditional plant knowledge as a starting point for identification, classification, and discussion of plant functions, rather than treating customary use as direct evidence of therapeutic efficacy.

That distinction is especially important in ethnopharmacological contexts. [Heinrich et al. \(2009\)](#) emphasize careful botanical identification and a clear separation between documented traditional use and experimentally established biological or pharmacological effects. In a biology classroom, students can compare how medicinal plants are named, grouped, and used in local knowledge systems with the scientific evidence available for the relevant species or compounds. Used in this way, ethnobotany connects cultural knowledge with biodiversity and plant science while keeping claims about bioactivity within the limits of the evidence.

7. Integrated mapping of Bugis folklore and biology concepts

Taken together, the six categories form a curriculum-facing map rather than a set of isolated examples. Table 3 presents the categories in a single view by aligning each folkloric element with the relevant biological concepts and curriculum topics.

Table 3. Mapping of Bugis folklore to biological concepts and curriculum topics

Folklore/Tradition	Key biological concepts	Related curriculum topics
I La Galigo epic & Sawerigading myth	Monozygotic/dizygotic twins; incest taboos and inbreeding depression; pedigree patterns	Genetics, heredity, population genetics
Mappacci ritual	Plant phytochemistry (lawsone, flavonoids); monocot fruit anatomy; insect metamorphosis (sericulture)	Botany, plant biochemistry, entomology, plant anatomy
Sawerigading rice (agrarian myth)	Plant domestication; local varieties (landraces); germplasm	Agricultural biotechnology, plant genetics, genetic conservation
Philosophy of siri' na pacce	Organism interdependence; system/community balance	Ecology, species interactions
Folk narratives of forests & sacred springs	Catchment ecosystems; sustainable resource management	Ecosystem ecology, natural resource conservation
Traditional medicine (ethnobotany)	Species biodiversity; pharmacognosy; bioactive compounds	Biodiversity, plant physiology, ethnopharmacology

Figure 2 condenses the mapping into a conceptual framework. It shows how Bugis local wisdom can operate as a contextual learning resource, how the six cultural domains connect with selected biological concepts, and where those concepts sit within the biology curriculum. The framework therefore treats folklore as more than cultural heritage while avoiding the opposite error of treating cultural meaning as biological evidence. The resulting map points to several promising uses of Bugis folklore in biology instruction. It may help make biological ideas more culturally recognizable and support discussion of ecological and cultural connections.

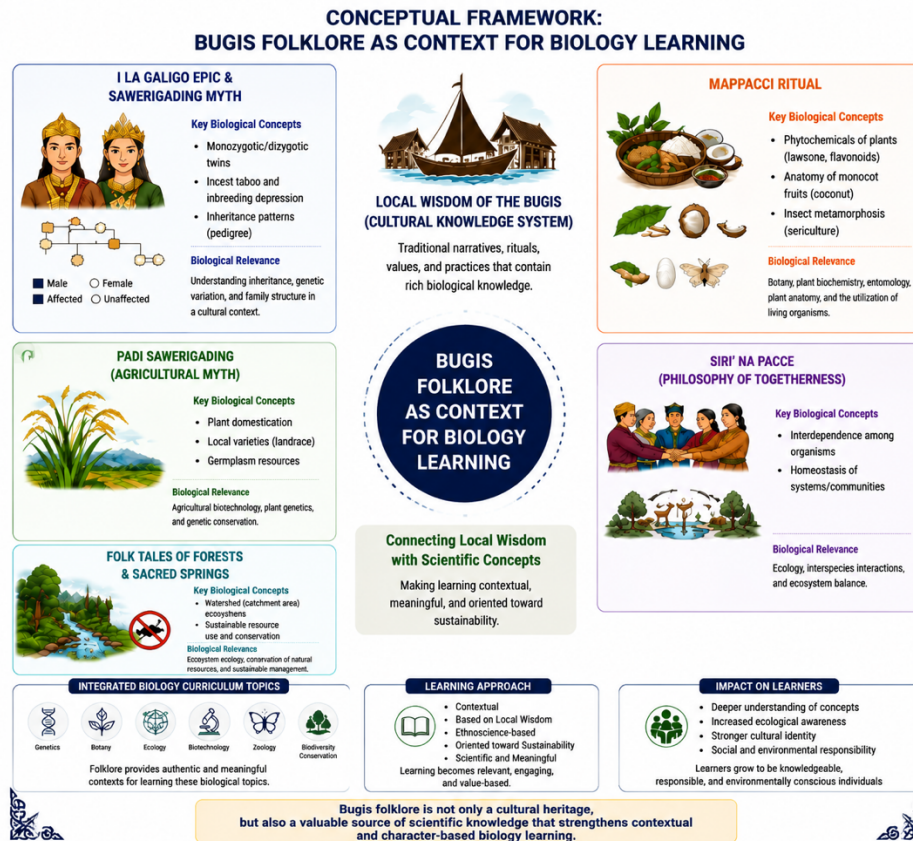


Figure 2. Conceptual framework for utilizing Bugis folklore as a context for biology learning

IV. DISCUSSION

The findings of this study indicate that Bugis folklore can provide a culturally grounded framework for connecting local knowledge with established biological concepts while maintaining a clear distinction between cultural meaning and scientific evidence. Rather than treating folklore as a decorative cultural layer, the mapping shows where it can enter biological reasoning. This is consistent with ethnoscience work that connects science content with culturally familiar knowledge. The need is particularly clear in biology, where abstract presentation can distance concepts from students' local realities (Hasanah et al., 2025). Indonesian studies of the *Mauwo* tradition at Lake Bakuok (Ilhami et al., 2020) and the *Bekarang* tradition (Hasanah et al., 2025) likewise link local practices with aquatic ecosystems, biodiversity, species interactions, adaptation, nutrient cycles, and resource conservation. The same mapping logic has been used outside biology: Fiskawarni et al. (2025), for example, connected the traditional game *congklak* with mechanics while retaining its local-wisdom dimensions. Together, these studies suggest that cultural context can make science more locally intelligible without replacing disciplinary explanation.

In practice, the framework can be translated into a four-part lesson. A teacher might begin with a locally meaningful narrative, ritual object, or environmental issue and invite students to articulate what they already know about it. The class can then observe, classify, model, or investigate the relevant biological phenomenon using evidence appropriate to the topic. A third step asks students to compare cultural meaning with scientific explanation, noting both overlap and difference. The lesson closes by considering ecological, ethical, or community implications. This sequence keeps local wisdom active throughout the learning process instead of mentioning culture only at the beginning of a lesson and then abandoning it during inquiry or assessment.

The contribution of this study is therefore one of synthesis, not causal evidence. Earlier research has usually connected a particular tradition with a particular science concept or learning medium. Here, those separate possibilities are organized into a curriculum-facing structure: a teacher can start from a Bugis narrative or material, identify the relevant biology concept, select an appropriate scientific explanation, and design an activity that moves from familiar context to evidence-based reasoning. The framework is compatible with Contextual Teaching and Learning, ethnoscience modules, field-based learning, and carefully designed digital media, but its instructional effectiveness still requires classroom evaluation ([Apriyani et al., 2022](#); [Apriansyah et al., 2024](#); [Veryani et al., 2025](#)).

One practical option is a local wisdom-based Contextual Teaching and Learning model. CTL rests on the idea that new knowledge becomes more meaningful when learners connect it with prior experience ([Johnson, 2002](#)). In folklore-based learning, stages such as constructivism, cultural inquiry, questioning, learning communities, modeling, reflection, and authentic assessment have been used at the secondary level with positive reported outcomes ([Apriyani et al., 2022](#)). For the present framework, the important point is not to prescribe a single model, but to ensure that the cultural context remains connected to the biological task students are asked to perform.

Technology offers another route. [Veryani et al. \(2025\)](#) show how symbols from *Mappacci* can be incorporated into augmented-reality biology media, while [Apriansyah et al. \(2024\)](#) provide an example of an ethnoscience-based electronic module on Bugis medicinal-plant diversity. Such materials, however, need careful handling. Ethnobotanical resources should follow established standards for documenting and validating traditional plant knowledge, including reliable botanical identification and a clear distinction between reported uses and experimentally confirmed bioactivity ([Heinrich et al., 2009](#)). There is also scope for interdisciplinary work: because Bugis folklore is already used in literature and character

education (HMZ, 2022), science and language teachers can build activities that connect cultural literacy with scientific reasoning. Conservation and sustainability offer a further application. Arifin et al. (2026) report that *siri' na pacce* can be used in biology learning to support ecological awareness and social responsibility. More broadly, Bugis epics, myths, rituals, and folk narratives retain educational and entertainment functions that can complement, but should not be confused with, their use as contexts for scientific learning (HMZ, 2022).

For teachers and resource developers, the framework also raises practical responsibilities. Cultural sources need to be traceable, knowledge holders should be consulted where appropriate, and locally documented uses must be separated from biomedical claims. Learning materials should identify the source of each cultural account, use accurate scientific names where possible, and ask students to justify biological claims with evidence rather than recall cultural details alone. These safeguards are consistent with ethical approaches to traditional ecological knowledge and with methodological caution in ethnobotanical research (Berkes, 2018; Heinrich et al., 2009). They also help keep the cultural material connected to the communities from which it comes.

The broader folklore literature supports this direction, although the evidence comes from different educational settings. Apriyani et al. (2022) reported positive attitudes and learning outcomes in contextual folklore-based learning that incorporated constructivism, cultural inquiry, questioning, learning communities, modeling, reflection, and authentic assessment. Bugis stories such as *La Upe dan Ibu Tiri*, *Putri Tandampalik*, and the tale of Sawerigading and We Tenriabeng have also been identified as sources of values for interdisciplinary educational materials (Rudyman et al., 2026). At earlier educational levels, principles such as *sipakatau* (respecting humanity), *sipakalebbi* (honoring one another), and *sipakatuwo* (supporting one another) have been used to introduce Bugis values of mutual respect and interdependence (Musi et al., 2022). These studies reinforce the material's cultural relevance while leaving the specific biology-learning effects of the present framework to future testing.

V. CONCLUSION

The study maps six Bugis cultural domains onto concepts in the biology curriculum while keeping cultural meaning distinct from scientific evidence. I La Galigo and the Sawerigading myth open discussion of kinship and genetics; *Mappacci* provides plant, fruit, and insect materials; Sawerigading rice connects cultural memory with domestication and crop diversity; *siri' na pacce* offers an analogy for ecological interdependence; forest and sacred-spring narratives support conservation reasoning; and traditional medicinal knowledge introduces

ethnobotany, biodiversity, pharmacognosy, and bioactive compounds. Across these categories, the value of the mapping lies in providing teachers with culturally recognizable entry points to established biological concepts. It does not, by itself, demonstrate that the approach improves learning. Its contribution is a structured way to connect local cultural knowledge with scientific reasoning without collapsing one into the other.

Two considerations should be acknowledged when interpreting the findings of this study. First, the cultural materials and literature included in the analysis represent only a selection of the broader and diverse body of Bugis traditions and local knowledge. Second, the conceptual relationships identified in the mapping are context-dependent and may be refined as additional cultural sources, scholarly perspectives, and locally grounded evidence become available. Future research may therefore expand the range of Bugis traditions examined and involve relevant cultural and disciplinary experts to further strengthen the interpretation and applicability of the framework. Such work could also explore how the proposed mappings can be adapted to different educational contexts and learning resources. Despite these considerations, this study contributes an integrative, curriculum-oriented framework that brings together previously dispersed connections between Bugis local wisdom and biological concepts. By maintaining a clear distinction between cultural meaning and scientific evidence, the framework provides a theoretically grounded basis for developing culturally responsive biology education and advancing research on the integration of local knowledge into science learning.

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Author contributions

Nurdiyanti, Dian Safitri, and Anisa: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft, and Writing – review & editing. All authors read and approved the final manuscript.

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Data availability

The materials and data supporting the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval

Not applicable.

Consent to participate

Not applicable.

Consent to publication

Not applicable.

Conflict of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Declaration of generative AI and AI-assisted technologies

During the preparation of this manuscript, the authors used ChatGPT (OpenAI, GPT-5.5) to improve the language and readability of the manuscript and to produce the illustrations presented in Figures 1 and 2 based on the authors' original drafts. Following the use of this tool, the authors carefully reviewed, verified, and edited the generated content as necessary to ensure its accuracy, consistency, and scientific integrity. The authors take full responsibility for the content of the published article.

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