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Familiarity And Uses of Common Ethnobotanical Plants Among Young Higaonon Students: Basis for a Contextualized Stem Lesson

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Abstract

This study explores the ethnobotanical knowledge and practices of young Higaonon students in Northern Mindanao, Misamis Oriental, Philippines, focusing on their familiarity and utilization of common medicinal and culturally significant plants. Rooted in the rich indigenous traditions of the Higaonon tribe, the research aims to document plant-based knowledge that has been transmitted across generations and assess its relevance in the context of modern education. Using qualitative methods such as structured interviews, focus group discussions, and participatory observation, the study identifies key plant species known to the students, their traditional uses (e.g., for treating wounds, fever, stomach ailments, and ritual purposes), and the extent to which this knowledge is retained and practiced. Results reveal that while some ethnobotanical knowledge persists among the youth, there is a noticeable decline in familiarity due to limited intergenerational transmission and the influence of modern healthcare systems. The findings underscore the importance of integrating indigenous knowledge into the STEM curriculum to promote cultural preservation, environmental awareness, and scientific inquiry. By contextualizing STEM lessons around local ethnobotanical practices, teachers can foster deeper engagement among Higaonon students and bridge traditional wisdom in biology at the secondary level. This study serves as a foundational step toward developing culturally responsive teaching materials that honor indigenous heritage while enhancing academic relevance and student identity in science learning. The results obtained from the study served as the basis for crafting the contextualized Problem-Based STEM lesson on the essential uses of ethnobotanical plants.

Keywords: Ethnobotanical Plants, Familiarity, Higaonon, STEM lesson, Uses

1. Introduction

Ethnobotany is generally defined as the study of plant and people relationships. This academic discipline was thought to emerge in the 19th century. It is one of the subdisciplines of ethnobiology, among others like ethnopharmacology, ethnomedicine, ethnozoology, ethnoecology, ethnomycology, and ethnoveterinary, with usually indefinite boundaries. The term "ethnobotany" was first defined in 1985 by John Harshberger as "the use of plants by aboriginal peoples". Subsequently, Schultes defined ethnobotany as "the study of the relationship which exists between people of primitive societies and their plant environment" (Alejandro & Dapar, 2020). Ethnobotany could also be a mixture of two terms "ethano" which means the study of plant culture and "botany" which means the study of plant species. It is a knowledge base field exploring the link between plants and folks (Chavda et al., 2022).

Every tribe all over the world has known for its ethnobotany and historical background. The scope of ethnobotany is in collection of various plants with medicinal and religious beliefs which involves in treating various diseases and performing various indigenous knowledge and various rituals. Knowledge on the use of plants for traditional medicine is maintained and developed in all indigenous societies in the world. In the Philippines, this knowledge is inherited from their great ancestors through verbal communication (Olowa et al., 2012).

Higaonon tribe is one of the 110 groups of indigenous peoples in the Philippines. Higaonon is derived from the native words "higa"(living), "goan"(mountains), and "onon"(people), or literally people of the living mountains or people of the wilderness (Luczon, 2021).People belong to this tribe are part of the twenty two (22) Indigenous People of Mindanao, otherwise known as Lumads. In 1982 the Higaonon population was 233,000 and in 1996, the defunct Office for Southern Cultural Communities (OSCC) estimated the number of Higaonon to be 312,840. They reside in all provinces of Northern Mindanao: Bukidnon, Misamis Oriental, Agusan del Norte/Sur, Lanao del Sur (along the boundaries of Misamis Oriental Province) and Camiguin Island.

Furthermore, the indigenous tribes of the Higaonon share a common root language, history and culture. They are nomadic tribes, traveling from one mountain to another, looking for fertile soil for a fruitful harvest. This tribe, also named "people of the wilderness", is one of the least known ethnic groups that inhabit the hinterlands of North-Central Mindanao. They are scattered over five provinces, Bukidnon, Agusan del Sur, Agusan del Norte, Lanao del Norte and Misamis Oriental. Ever since "the Times of Creation " the Higaonon have lived and continues to live in their ancestral forest homes, undisturbed, managing the forest in a natural way (Jong, 2010).

For decades, the Higaonon people have struggled tirelessly for their independence as a tribe, their rights to cultural integrity and the right to self-determination. They have also managed to maintain the skills and knowledge that will protect its forested mountains. They need to secure their Ancestral Domain and forest home against destruction by loggers who started cutting their way into the forested homeland more than sixty years ago.

Moreover, the Higaonons have managed to maintain the knowledge and skills that could protect their forested mountains as their ancestral domain (Olowa et al., 2012). According to this study, the Higaonons' own indigenous knowledge in traditional medicine is clearly exhibited using medicinal or traditional plants. They believe that these plants are protected by supernatural beings that ensure a sustainable pattern of their medicinal plant use.

However, younger members of the Higaonon community are less knowledgeable because they are taught by their elders only once they reach a certain age or rank in their society, such as a "Datu" or "Chieftain" (Olowa et.al., 2012). Looking at the current situation in this connection, the medicinal plants in the community and in any other areas in the country, as many important medicinal species of plants, are facing danger of

extinction due to the continued deforestation and land conversion in different areas in the Philippines (Olowa et al., 2012).

The Indigenous Peoples Education (IPEd) program of the Department of Education (DepEd) Philippines, as outlined in DepEd Order No. 62, s. 2011, affirms the right of Indigenous Peoples (IPs) to an education that is culturally responsive, inclusive, and empowering. This policy framework recognizes the importance of integrating Indigenous Knowledge Systems and Practices (IKSPs) into the formal curriculum to preserve cultural heritage and promote community-based learning. Aligned with this directive, the present study seeks to explore the familiarity and practical uses of common ethnobotanical plants among young Higaonon students. Ethnobotanical knowledge, such as traditional healing, food preparation, and ecological stewardship, is a vital component of Higaonon identity and daily life. By documenting and analyzing this knowledge, the study contributes to the localization and indigenization of the curriculum, as mandated by DepEd Order No. 43, s. 2013, which implements the Enhanced Basic Education Act of 2013 (RA 10533).

This research supports the development of contextualized learning materials that reflect the lived experiences of Higaonon learners. It also promotes intergenerational learning, where elders and cultural bearers serve as knowledge holders, reinforcing the community's role in education. Furthermore, the study fosters environmental literacy, health awareness, and cultural pride, which are core values in the K to 12 Curriculum. Ultimately, this study is not only a contribution to academic discourse but also a meaningful step toward educational equity and cultural sustainability for Indigenous learners in Northern Mindanao.

Furthermore, this study is anchored on the phenomenological approach, as reflected in the work of Cordero et al. (2022), which emphasizes understanding the lived experiences and cultural practices of individuals within their specific contexts. Cordero et al. explored how Filipino nurses engage with traditional health remedies, highlighting the role of Indigenous Knowledge Systems (IKS) in shaping health behaviors and cultural identity. Similarly, this research investigates the familiarity and uses of ethnobotanical plants among young Higaonon students, recognizing that such knowledge is not merely functional but deeply embedded in ancestral wisdom, ecological relationships, and cultural values.

The framework also draws from enculturation theory, which explains how individuals internalize cultural norms and practices through socialization and intergenerational learning. In the Higaonon context, ethnobotanical knowledge is passed down through oral tradition and daily practice, forming a vital part of the learners' identity and worldview. By examining how young students engage with this knowledge, the study contributes to a broader understanding of culturally responsive education, in line with the Indigenous Peoples Education (IPEd) Framework of the Department of Education.

Generally, this study seeks to unearth the living legacy of Higaonon ethnobotanical wisdom among its youth, identifying the plants they are familiar with, distinguishing their remedies and uses in a daily basis. By bridging ancestral knowledge with modern science, it aims to transform traditional plant use into powerful, place-based STEM lessons that celebrate culture while cultivating curiosity.

2. Methodology

2.1 Target Group

The respondents of the study were the two hundred (200) Higaonon Junior High School students enrolled in the school year 2022-2023 from Rizal National High School, Claveria West district, Misamis Oriental, Philippines.

2.2 Methods of Inquiry

The study employed the descriptive survey design to describe and elaborate on the familiarity level of the respondents with the common ethnobotanical plants found in the locality. An adopted and researcher-modified questionnaire from Cordero et al. (2022) structured survey questionnaire was used to assess students' familiarity and usage of ethnobotanical plants. It included Closed-ended questions for plant recognition and usage. Modified Likert-scale items from the study of HadjiAbas and Salic (2016) and Open-ended questions to gather cultural insights and personal experiences were utilized in the study. The instruments were validated by experts and pilot-tested with Higaonon students. Furthermore, the study was conducted with 200 Higaonon students (Grade 7-10) of Rizal National High School, one of the Junior High Schools of Claveria West District, Misamis Oriental, Mindanao, Philippines. Surveys were administered face-to-face, with support from teachers and cultural facilitators. Ethical protocols were followed, including informed consent and confidentiality. The quantitative data were analyzed using descriptive statistics (frequencies, percentages, mean scores). The qualitative responses were examined through thematic analysis to identify cultural patterns and plant-related practices. Comparative analysis was done across grade levels and gender to explore trends and differences.

2.3 Ethical Consideration

A letter of request was handed to the head of the school where the study was conducted. The researcher assumed the responsibility to conduct research, considering the sensitivity of the welfare and dignity of the respondents, adhering to the standard protocol in collecting data. Additionally, the assent letter for minors was duly signed by the respective parents, as was the consent letter for minors, which was signed by the respondents before the study was conducted.

2. Research Findings

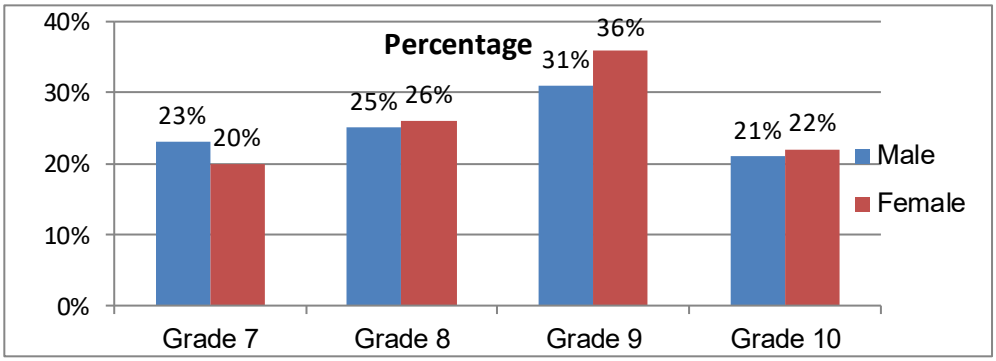

Figure 2. Respondents by Year Level

Figure 1. presents the percentage breakdown of the 200 Higaonon Junior High School student respondents according to their grade level and gender. This demographic profile is essential in understanding the scope and representativeness of the study population. In Grade 7, 23% of respondents were male and 20% were female, indicating a slightly higher participation of boys at the entry level of junior high school. In Grade 8, the distribution was more balanced, with 25% male and 26% female respondents. The highest concentration of respondents came from Grade 9, with 31% male and 36% female students. This suggests that students in this year level were the most accessible or most engaged in the study, possibly due to their maturity and increased academic exposure. In

Grade 10, the numbers slightly declined, with 21% male and 22% female respondents, which may reflect either a smaller population in that cohort or reduced availability due to academic demands.

All respondents were members of the Higaonon tribe, ensuring that the study remains culturally specific and aligned with the goals of Indigenous Peoples Education (IPEd). This demographic spread across four grade levels allows for a comparative analysis of ethnobotanical knowledge across different stages of adolescence. It also provides insight into how familiarity with traditional plant use may evolve with age, education level, and gender. This distribution ensures that the findings are inclusive and representative of both male and female Higaonon students, offering a more nuanced understanding of how ethnobotanical knowledge is retained, practiced, and possibly transmitted within the community.

Table 1: Respondents' Familiarity Level on Ethnobotanical Plants

STATEMENT	Mean	Description
I know what Ethnobotanical (herbal) plants are.	3.40	Highly Familiar
I know that there are plenty of Ethnobotanical(herbal) plants in our community.	3.15	Familiar
I know that Ethnobotanical(herbal) plants can be used as medicine to cure ailments.	3.73	Highly Familiar
I know that there are Ethnobotanical(herbal) plants that can be used as ingredients or spices.	2.52	Familiar
I know that Ethnobotanical(herbal) plant has specific part that can be used to cure ailments.	3.20	Highly Familiar
I know that Ethnobotanical(herbal) plant has specific part that can be used as an ingredient or a spice.	2.51	Familiar
I know how to prepare herbal plants to cure ailments.	3.24	Familiar
I know that there is/are herbalist/s in our area.	3.23	Familiar
I know that herbal plants can be prepared in different ways depending on what ailment it will cure.	3.22	Familiar
Mean	**3.13**	Familiar

As shown in Table 1, the respondents were familiar with the Ethnobotanical plants commonly found in the locality. However, its familiarity with the description and uses was at a minimal level. The result implied that the young generations were less knowledgeable about how these plants were prepared and administered. It somehow supported the result from the study of Olowa et al. (2012), stating that the young generation had less knowledge on these plant species due to the failure to document the essential knowledge gained from the ancestors or tribal chieftains. Moreover, the studies of da Silva (2019), stated that the low level of awareness on Ethnobotanical plants can be associated to lack of information. Such lack of information may be due to young generation's lack of interest in useful plants species and may be influenced by increased technology. Thus, such useful knowledge concentrated with the older members of the community, should be shared with other generations, as it could be lost if not passed on.

Furthermore, the table further revealed the young generation's total acquisition of the skills on how to prepare plant parts that can cure disease was also minimal. Most of the young Higaonon students were incapable of preparing and to what methods appropriate for its administration. The study of Emre (2021), discussed on the connection between the old and young generations' skills in utilizing ethnobotanical plants was the key associating

to the preservation of functional skills gained. Additionally, conducting ethnobotanical studies revitalized this bridge of knowledge between old and new generations and help form solid foundation for its preservation. However, there were prevalent factors affecting the transfer of knowledge and skills on preparing ethnobotanical plants as stated by the study of Hu et. al. (2020). It was revealed in this study that the tribe's traditional knowledge on herbal medicine was threatened due to a lack of written records, conservative inheritance patterns, and rapid economic development. Therefore, the investigation and documentation of medicinal plants and their associated indigenous wisdom were deemed necessary.

The traditional knowledge and skills of the respondents in utilizing ethnobotanical plants as herbal medicine can be associated with more opportunities for potential therapy or treatment of common diseases, just like cough, skin allergies, toothache, anemia, and even toothache. This result corroborates the studies of Cordero et al. (2022), stating that the knowledge gained from the elders on the awareness and uses of Ethnobotanical plants was based on how it was passed on from one generation to another. The transfer of knowledge was mostly expressed in oral forms the influenced by their religious and cultural beliefs. In the Philippines, important indigenous knowledge of medicinal plants was highly preserved by the indigenous people. The application of medicinal plants by many tribes was based on the knowledge, skills, and practices supported by their beliefs and experiences used to maintain and improve health as well as prevent diseases (Cabugatan et al. 2022).

There is a need to inculcate and put into practice the traditional knowledge among young generations to strengthen the cultural identity while meeting DepEd's goals for inclusive and responsive education. Flores-Silva et al. (2024) emphasized that as formal education becomes more widespread in Indigenous communities, there's a risk that traditional ecological knowledge may be lost or undervalued. To address this, they proposed using ethnobotany as a bridge between traditional knowledge and modern science. According to their study, Ethnobotany served as a gateway to scientific concepts such as taxonomy, ecology, and plant physiology. Students were able to share and expand their existing knowledge through structured learning. In this manner, learning became more inclusive, as students saw their culture reflected in the curriculum. Students not only shared their prior knowledge but were also able to expand that knowledge with scientific information.

The ethnobotanical knowledge can be regarded as a contextual resource in learning Biology and contextualized STEM lessons. Mualimin et al. (2025) explore how traditional Javanese rituals, such as birth, marriage, and death ceremonies, incorporate specific plant species that hold cultural, symbolic, and practical significance. These ethnobotanical practices can be used as contextual resources for teaching biology in secondary education. The study emphasizes that ethnobotanical knowledge serves as a bridge between traditional wisdom and scientific learning; offers rich material for teaching biodiversity, taxonomy, and ecology; enhances student engagement by connecting lessons to familiar cultural practices; and supports character-based education, promoting respect for heritage and nature. Local wisdom, as integrated into science instruction, can enhance student engagement, promote meaningful learning, and strengthen both plant and cultural literacy. Ethnobotanical knowledge is a valuable educational tool that fosters scientific literacy, cultural pride, and community engagement.

The findings of the study indicate a moderate level of familiarity among Higaonon students with common ethnobotanical plants in their community. This suggests that while traditional plant knowledge remains present among the youth, it may be at risk of gradual decline without intentional reinforcement through education. The result underscores the importance of integrating Indigenous Knowledge Systems and Practices (IKSPs) into the formal curriculum, particularly through contextualized STEM lessons that reflect the

students' cultural environment. By doing so, educators can foster deeper scientific understanding while preserving the rich ethnobotanical heritage of the Higaonon tribe, ensuring that this ancestral wisdom continues to thrive across generations.

Table 2: Common Ethnobotanical Plants used by the Respondents as Herbal Medicines

Scientific Name	Family	Common Name (English/ Tagalog)	Local Name	Plant Part Used	Method of Preparation	Type/s of Disease/s or ailments can be cured	f	%
Coleus aromaticus	Lamiaceae	Oregano	Kalabo	Leaf	Crushed	Cough and colds	200	100%
Citrofortunella microcarpa	Rutaceae	Calamansi	Lemonsito	Fruit	Extract	Cough	187	86%
Artemisia vulgaris	Asteraceae	Mugwort	Hilbas	Leaf	Immersed with Water	Cough and Colds	150	75%
Psidium guajava	Myrtaceae	Guava	Bayabas	Leaf	Decoction	Antiseptic Diarrhea	145	73%
Zingiber officinale	Zingiberaceae	Ginger	Luy-a	Root/Rhizome	Raw	Sore Throat Cough	130	65%
Allium sativum	Amaryllidaceae	Garlic	Ahos	Bulb	Raw/Decoction	Toothache and used to treat high blood pressure	124	62%
Chromolaena odorata L.	Asteraceae	Butterfly weed	Hagonoy	Leaf	Crushed	Wounds Skin Allergy	118	59%
Lagerstroemia speciosa	Lythraceae	Giant crepe-myrtle	Banaba	Leaf	Decoction	Helps to reduce blood sugar	115	56%
Blumea balsamifera L	Asteraceae	Sambong	Pahid	Leaf	Immersed with water	Cough UTI	83	42%
Vitex negundo	Verbenaceae	Lagundi	Lagundi	Leaf	Decoction	Cough	61	31%

Table 2 shows ten (10) Ethnobotanical plant species that were familiar among the respondents and easily found in the community. From the result, *Coleus amboinicus,* locally known as *Kalabo,* belonging to *Lamiaceae family,* was the most familiar in terms of medicinal uses. The leaves are the most preferred plant part since they are easier to collect and readily available in the community. The Higaonons were passionate enough about cultivating and preserving the ethnobotanical plants, as they used to thrive in the mountains and lived by their culture. This statement corroborated the study of Olowa et al. (2012), reporting that the frequent use of leaves as compared to other plant parts in medicinal preparations indicated that the survival and continuity of useful medicinal plants in Rogongon were greatly maintained and protected by the Higaonons.

The leaves were the most utilized plant parts, especially in preparing herbal medicines. The high usage of leaves in preparing herbal medicines was due to the reason that it was easier to collect them with fewer threats to the local flora (Nuneza et. al., 2021). Leaves have high storage of chemical compounds through photosynthesis, the active components of most herbal preparations in high concentrations (Guevara & Garcia, 2018). Also, the site for the synthesis of secondary metabolites as a result of frequently utilizing the leaves can be justified by the abundant chemical compositions they contain (Hamel et.al. 2018). In addition, the study by Khan et al. (2014) stated that the use of leaves was not detrimental to the plant life cycle as compared with using other plant parts.

Furthermore, *Kalabo* was known to the respondents as a cure for cough. This was also the claim of the local herbalists. The juice made of oregano's leaves was known in the Philippines as a cure for dyspepsia, asthma, chronic coughs, bronchitis, colic, flatulence, and rheumatism. Lopez et al. (2017) cited that Cuban oregano leaves were simply eaten fresh for coughs, colds, malaria fevers, asthma, bronchitis, mouth and nasal infections, diarrhea, indigestion, flatulence, dyspepsia, epilepsy, rheumatism, kidney stones, and helminthiasis. While the fresh crushed leaves were applied to burns, sprains, skin infections, scorpion bites, or on the forehead to ease a headache. On the contrary, the

Department of Health did not recommend *Kalabo* as a herbal medicine in treating cough due to its hairy structure that could trigger itchiness in the throat, urging a person to cough. However, several clinical and scientific studies can be conducted to further elaborate on this cause.

Calamansi, locally known as *Lemonsito,* was the second most familiar among the respondents as a medicinal herb since its fruit can easily be collected in the garden. This plant species is a naturally-grown citrus tree and one of the sources of staple fruit juice in the Philippines (Titong, & Vergara, 2010). It originated in Southeast Asia, mainly grows in Southeast Asia and tropical regions of China, and has a long history of cultivation in Hainan Island. Looking at the chemical constituents, Calamansi fruit is rich in vitamin C, aromatic oils, carotenoids, and other natural substances, which have lots of health benefits for humans, such as beneficial effects for human eyes, good for treating cough, asthma, high blood pressure, and preventing arteriosclerosis. Calamansi fruit had a fine texture and a sour taste. Calamansi juice is widely loved as a delicious fresh condiment (Hui-Xin et al., 2022).

Seventy-five percent (75%) of the respondents were familiar with and utilized *Artemisia vulgaris,* locally known as *Hilbas,* for medicinal purposes, as commonly used in treating cough and colds. Immersion of the leaf in water was the most common method used for administration. Mugwort, a common herbaceous plant exhibiting high morphological and phytochemical variability depending on the location where it occurs. Ekiert et al. (2020) considered this ethnobotanical plant as the "mother of all herbs" in the Middle Ages because of the popularity of its medicinal uses almost all over the world. Moreover, this species was also used as a raw material due to the presence of essential oil, flavonoids, and sesquiterpenoid lactones and their associated biological activities.

More to the study of Ekiert et al. (2020), *Artemisia vulgaris* has been mainly used for treating gynecological ailments and gastrointestinal diseases. Also, it was proven that this species exhibits antioxidant, hypolipidemic, hepatoprotective, antispasmolytic, analgesic, estrogenic, cytotoxic, antibacterial, antifungal, hypotensive, and broncholytic effects. Thus, different applications of this plant species have been possible due to its rich chemical composition, which especially includes essential oils, flavonoids, sesquiterpene lactones, phenolic acids, coumarins, and other groups of metabolites.

Psidium guajava ranked as the fourth ethnobotanical plant commonly used by the Higaonons, through utilizing its leaves for medicinal purposes. It was a commonly known tropical tree, abundant for fruit, but its leaves were also widely used by most of the Higaonons. Naseer et al. (2018), cited that guava leaf extract was used as a medicine for cough, diarrhea, and oral ulcers, and in some swollen gum wounds. Guava leaves contain many compounds that act as fungistatic and bacteriostatic agents. Guava has a high content of important antioxidants and has radio-protective ability. Quercetin is considered as most active antioxidant in the guava leaves and is responsible for its spasmolytic activity. Its ethyl acetate extract can stop the germ infection and thymus production. In addition, the study of HadjiAbas and Salic (2016) stated that guava leaves were known to the local herbalists as an effective treatment for wounds and are widely used in the Philippines as herbal medicine. Also, the Department of Health (DOH) recognized its antiseptic capability used by many Filipinos for toothache, gum swelling, and to hasten wound healing.

Ginger (*Zingiber officinale*) ranked as the fifth species commonly used by the young Higaonons as herbal medicine. This species, not only used in dietary condiments, but also for medicinal purposes, consumed raw with the rhizome or fruit to treat cough and even sore throat. This plant originated as an endemic species from India and is cultivated in South and South-East Asia, Africa, Latin America, and Australia (Khodaie and Sadeghpoor, 2017). According to the study of Ali et al. (2008), this has been a popular spice and herbal medicine for thousands of years. It has a long history of use in Asian,

Indian, and Arabic herbal traditions and is used to help treat the common cold, flu-like symptoms, headaches, and painful menstrual periods. In the study, the young Higaonon students were aware of its medicinal uses by eating the rhizome of this plant as raw medicine for cough and colds.

Sixty-two percent (62%) of the respondents were familiar with *Allium sativum,* commonly known as Garlic, as a herbal medicine for treating toothache and lowering high blood pressure. This result supported the study of Tudu et al. (2022), stating that Allium sativum helps to treat high blood pressure and other cardiovascular ailments, neoplastic growth, rheumatism, diabetes, intestinal worms, flatulence, colic, dysentery, liver diseases, facial paralysis, tuberculosis, and bronchitis. This plant originated in Asia, and is widely cultivated in Egypt, Mexico, China, and Europe, and highly consumed in Iran, where its foliage, flowers, and cloves are employed in local medicine.

Chromolaena odorata L., locally known as *Hagonoy,* was also familiar and used by the Higaonons as a herbal medicine to cure wounds and allergies. This has been used as a traditional medicinal plant that is widely used for its wound-healing properties. Its efficiency of healing wounds came from the antioxidant property of its leaves, which enhanced the conservation of fibroblast and keratinocyte proliferation on those wounds.

Lagerstroemia speciosa, locally known as *Banaba,* ranked eighth as commonly used by the respondents for medicinal purposes. The leaf of this plant has been utilized traditionally to lower blood sugar because of its antioxidant properties and anti-obesity effects. The study of Garner-Wizard et al. (2022) reported that the corosolic acid from banaba leaves helped in regulating carbohydrate metabolic pathways, enhancing cellular glucose uptake, inhibiting disaccharide hydrolysis, and regulating peroxisome proliferator-activated receptors. Its effects on glucose and lipid metabolism may be useful in managing the sugar levels of the body.

Blumea balsamifera, locally known as *Pahid,* ranked as the ninth ethnobotanical plant used as herbal medicine by the respondents. The leaves of this plant were utilized in treating cough and Urinary Tract Infection (UTI). The herbalists confirmed this usage as the traditional medicine to treat these ailments. In the Philippines, sambong is included in the list of 10-recognized medicinal plants by the Department of Health (DOH)and has been clinically proven for use in the treatment of kidney stones and as a diuretic (Tolosa et al., 2020). In the study, the respondents were aware of using *Pahid* leaves in treating cough and UTI by immersion of its leaves directly in water and consumed at least three to four times daily.

Vitex negundo, commonly known as *Lagundi,* ranked tenth as commonly used herbal medicine by the respondents. The leaves were primarily used to treat cough through decoction and regarded as effective traditional medicine, especially in children with mild and moderate cough, as confirmed by the herbalists and community elders. Alegado-Bagaoisan et al. (2020) reported that the leaf extract of this plant exhibited numerous pharmacological actions with multiple mechanisms activated by several different types of compounds. There was considerable ethnomedical and pharmacological evidence that *Vitex negundo* possessed analgesic and anti-inflammatory, antihistaminic, antibacterial, antioxidant, and bronchodilating potential. Its chemical compositions served as the main reasons for being effective as a cough expectorant.

On the other hand, decoction was the most frequent method in preparing medicinal plants because this is the easiest way to do. From this study, decoction is frequently preferred by the Higaonons, mostly used to cure cough, lowering fever, diarrhea, and lowering blood sugar. This result corroborates the findings of Mapatac (2019), wherein decoction was the most employed method of preparing medicinal plants used by the Mamanwas of Surigao del Norte and Agusan del Norte, Philippines. The result was similar to the findings of other ethnobotanical surveys conducted by Tantengco et al. (2018) in Dinalupihan, Bataan, and Morilla et al. (2014) in Dumingag, Zamboanga Del Sur. Both

previous studies documented that oral intake of decoction was the most common route of medicinal plants intake and administration. Other methods of preparing medicinal plants, as a result of the study, are pounding or crushing and immersing in water. Also, pounding or crushing the leaves, just like the hagonoy plants, were all immediate treatments of cuts and wounds and applied directly to the affected area.

Table 3: Ethnobotanical Plants that are commonly found in the locality and used by the respondents for Consumption

Scientific Name	Family	Common Name (English/Tagalog)	Local Name	Plant Part Used	Mode of Consumption/ Usage
Citrofortunella microcarpa	Rutaceae	Calamansi	Lemonsito	Fruit	Peel Eaten Directly
Psidium guajava	Myrtaceae	Guava	Bayabas	Fruit	Eaten directly
Cocos nucifera	Arecaceae	Cocount/Niyog	Lubi	Fruit	Juice (Coconut Water) Scrape (Fruit)
Mangifera indica	Anacardiaceae	Mango	Mangga	Fruit	Peel and Eaten directly
Persea americana	Lauraceae	Avocado	Abokado	Fruit	Peel and Eaten Directly
Allium sativum	Amaryllidaceae	Garlic	Ahos	Bulb	Used as Spices
Allium cepa	Amaryllidaceae	Onion	Bombay	Bulb	Used as spices
Cymbopogon citratus	Poaceae	Lemon Grass	Tanglad	Leaves	Used as spices
Capsicum annuum	Solanacea	Bird's eye chilli	Sili	Fruit	Used as spices
Zingiber officinale	Zingiberaceae	Ginger	Luy-a	Root/Rhizome	Used as spices

Table 3 showed ten (10) commonly found ethnobotanical plants that were commonly utilized for food consumption and used as spices by the respondents daily. From the table, it was observed that most of the species were fruit-bearing plants in nature and commonly found in the community, namely: Calamansi (*Citrofortunella microcarpa),* Guava *(Psidium guajava),* Coconut *(Cocos nucifera),* Mango *(Mangifera indica), and* Avocado *(Persea americana).* The fruit of these Ethnobotanical plants was consumed roughly as raw foods. The young Higaonons were fond of eating these fruits not only because of their availability in the community but prevalently good source of vitamins and minerals needed for body nourishment. These fruit-bearing ethnobotanical plants belong to the food system of the Higaonon tribe since their way of living evolved in cultivating the land in the mountains as their land territory. Thus, planting fruit-bearing trees was one of their trademarks within the tribe.

Moreover, the richness of fruit-bearing ethnobotanical plants, which were edible, played a vital role in the food consumption of the Higaonon tribe since most of them resided in the mountainous place and surroundings. It affirmed to the study of Buenavista et al. (2022), stating that the richness of agrobiodiversity and wild edible plants was vital enough for the food security and resilience of the Higaonon tribe. The mountainous terrain of the provinces of Bukidnon and Misamis Oriental presented a challenge for rice cultivation and provided an avenue for planting fruit trees for consumption.

Garlic (*Allium sativum*), Onion (*Allium cepa*), and Ginger *(Zingiber officinale*) were commonly used as spices in culinary services daily. The bulbs and rhizomes of these plants were the ones utilized. Their aroma and distinct flavor added richness to all non-sweet foods. Garlic originated in Asia, and is also widely cultivated in Egypt, Mexico, China, and Europe, and highly consumed in Iran, where its foliage, flowers, and cloves are employed in local medicine. The young Higaonons used these in culinary purposes since

these were the most common spices used in cooking viand and preparing other foods that are compatible with these spices. According to them, their parents and grandparents introduced them to its uses in cooking. Thus, these plants were considered the traditional foods of the Higaonon tribe, which were always available in the kitchen.

Lemongrass (*Cymbopogon citratus*), locally known as "Tanglad", is commonly used as a spice by the respondents and widely used in savory dishes and meat, poultry, seafood, vegetable curries, and soup dishes. This plant originated in India and has grown throughout Asia. A woody, blue-green grass, with sharp-bladed leaves, that grows in clumps to a height of between three to six feet tall (McCafferty, 2021). The Higaonon tribe lavished in using lemongrass in most of their soup dishes since this plant was locally available in the garden or field.

Bird's eye chilli *(Capsicum annuum),* an ethnobotanical plant that was impossibly not visible on the Higaonons' table. This plant was always available in the backyard and used as a spice and appetizer in almost all food dishes. This plant served as a dietary spice because of its active constituents, providing various beneficial effects on the gastrointestinal system by a variety of mechanisms such as influence of gastric emptying, stimulation of gastrointestinal defense and absorption, stimulation of salivary, intestinal, hepatic, and pancreatic secretions (Maji and Banerji, 2015).

The young Higaonons were trained to plant all the available ethnobotanical plants and utilized them as herbal medicine and food spices. This statement supported the study conducted by Samdhana Institute in 2023, stating that the Higaonon in Dulangan Ancestral Domain in Misamis Oriental and the Calamian Tagbanwa in Coron town in Palawan, embraced the culture in the way they provided food for themselves. All they needed to do was grow their own crops or pick edible plants that grow freely in their surroundings, hunt in the forests, and fish in the sea and rivers. Indeed, the Higaonons were resourceful in nature, and so they can thrive in places where they can hunt for food to eat.

However, as years went by, the Higaonon tribe started to adopt a gradual change in society, and so they became reliant on buying food from the market. But recently, a forum conducted by the Agrobiocultural Diversity of Indigenous Food Systems (ABCD in Food) addressed the cause of relying on food consumption in the market. This was a project facilitated by the Samdhana Institute, stating that the eventual reliance on the market didn't come as a choice; as the community members themselves put it, it was forced by factors like land use conversion, deforestation, development aggression, soil degradation, climate change, and displacement (The Samdhana Institute Article, 2023). These factors were valuable reasons implying a gradual culture change that contributed much to the failure of imparting the essential knowledge and skills in utilizing ethnobotanical plants as a functional resource.

The results of the study served as a benchmark in constructing a contextualized lesson on the essential uses of common ethnobotanical plants. Also, exploring possible solutions was aimed at addressing this issue among the young Higaonon students. A Problem-Based Contextualized lesson plan was crafted, providing comprehensive information addressing the issue of undocumented knowledge on ethnobotanical plants with a possible prototype or product *(Refer to Appendix A)* as an outcome manifesting the transfer of knowledge and skills among the young Higaonons of today's generation. It was constructed to integrate Science, Technology, Engineering, and Mathematics (STEM) concepts to apply knowledge gained from utilizing ethnobotanical plants. Maximizing the 21st-century skills, namely: *creativity*, *critical thinking*, *collaboration,* and *communication,* was also highlighted through conducting the lesson. From these skills, the students can work together to create innovative solutions to real-world problems and communicate their solutions with others (Beers, 2015). Figure 1 shows the process of conducting a contextualized STEM lesson to the students.

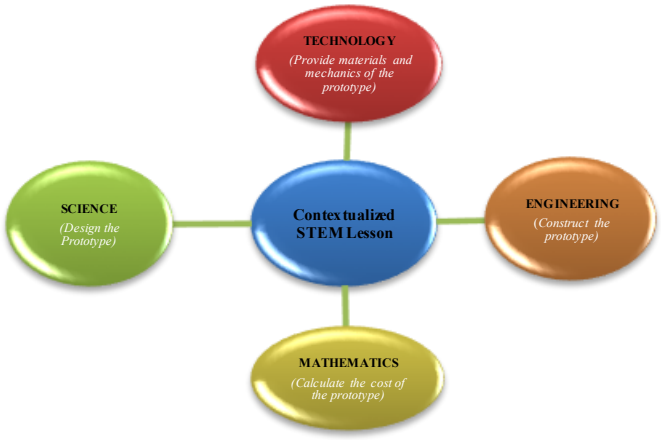

Figure 2. Diagram in Conducting Contextualized STEM Lesson

4. Conclusion

From the study, the following were obtained:

1. The respondents were familiar with the common ethnobotanical plants found in the community and their uses.

However, their familiarity level was considered minimal based on the weighted mean, 3.13.

2. Kalabo, Lemonsito, Hilbas, Bayabas, Luy-a, Ahos, Hagonoy, Banaba, Pahid, and Lagundi were commonly used

herbal medicines.

3. Lemonsito, Bayabas, Lubi, Mangga, and Abokado were the common ethnobotanical plants in the community used

for food consumption. While Ahos, Bombay, Tanglad, Sili, and Luy-a were commonly used spices among the

young Higaonons.

4. Among the ethnobotanical plants, Lemonsito and Luy-a were the species used as herbal medicine and for food consumption among the young Higaonons.

5. Recommendations

From the study, the following were recommended:

1. The essential uses and consumption of Ethnobotanical plants could be integrated into the Junior High School Science curriculum using varied and suitable learning strategies that would enhance the 21st-century skills of the students in transferring traditional knowledge not only into a documented one but also into a functional resource.

2. Constant practices and proper utilization of the common ethnobotanical plants in the locality could be infused into the community to retain their value and essential uses.

3. Future research may include the possible side effects of using ethnobotanical plants as herbal medicines.

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Contextualized Lesson Plan on the Essential Uses of Common Ethnobotanical Plants Grade 10 Students (developed regarding Sutaphan and Yuenyong, 2019)

Objectives:

At the end of the lesson, the students are expected to:

1. Demonstrate understanding of the essential uses of common ethnobotanical plants in the locality;
2. Craft a homemade product/prototype as an application of the essential uses of common ethnobotanical plants in the locality; and
3. Showcase the crafted product/prototype.

STAGE	ACTIVITY
1. Identification of Social Issues	Introduction: Claveria, Misamis Oriental is a first-class municipality in the Province of Misamis Oriental. According to the 2020 census, it has a population of 52,478 people. It is the only landlocked municipality of Misamis Oriental. It is also the largest in terms of land area in the province. The town was once named *Tikala,* a native term for "wonder". Tikala was once ruled by Datu Manlumupog, a warrior of the native aborigines known as the "Higaonons", meaning people of the land. The Higaonons observed simple living but with high regard to nature. For them, the vast and rich environment they have means life to them and this is manifested by their unique datu system. Land is life because they believe that is a gift from the Creator, *Magbabaya*. It must be taken care of under the stewardship of the great, great-great ancestors whose spirits continue to keep watching over it so it could be used for generation to generation. Ethnobotanical plants are utilized with various purposes as part of their daily living. However, the knowledge on its essential uses remains undocumented. Thus, there is a need to integrate lessons on ethnobotanical plants to address this issue. From this scenario the teacher will: • Show a video/documentary on the life of Higaonons before and now. • After watching the video, the teacher will ask the students on the possible issues about the life and livelihood of Higaonons. • Questions on how to utilize the common ethnobotanical plants as a part of livelihood will also be asked to the students. • The students will be divided into three groups and discuss the possible solutions to address the issue on the way of living. • Each group is assigned as the Science Group, Mathematics Group and Engineering and Technology Group to obtain a possible product to address the issue on the essential uses of common ethnobotanical plants that are locally available.
2. Identification of Potential Solutions	Procedures: 1. The science group will design in crafting a product that can be produced in utilizing the common ethnobotanical plants in the locality. 2. The math group will calculate the cost of the needed materials of a crafted product. 3. The Engineering and Technology group will decide the needed materials for the product.
3. Need for Knowledge	• The teacher will discuss on the concepts of the lesson • The teacher will show a video and discuss on techniques and uses of utilizing the products as a source of living • Discuss the possible precautions to consider in crafting a homemade product
4. Decision-making	• Make a list of possible solutions to the identified social problem • Select the best possible solution to the issue considering the following STEM's capitals -physical, financial, social, human and natural

STAGE	ACTIVITY
	• Decide on the output and utilized the commonly available ethnobotanical plants in the community to obtain a product • Each group will present the chosen solution to the issue in the class
5. Development of Prototype or Product	The teacher will give the rubric as a basis of evaluating a crafted product/solution to the issue. Develop a prototype or product based on the chosen solution. Example of Possible Solution(Crafting a Home-Made Soap from Kalabo Leaves) *Utensils:* Plastic pail Wooden ladle or bamboo stick Glass or cup Mortar and pestle Cheese cloth or strainer Knife Chopping boardCooking pot (preferably made of clay, enamel, stainless or glass) Stove Plastic molders Students will decide the procedures  *Materials:* 1 glass Caustic Soda (NaOH) 3 glasses Kalabo decoction (cooled) 5 glasses cooking oil coloring powder (optional) *Procedure:* 1. Prepare the materials and the utensils needed. 2. Measure 1 glass of caustic soda and 3 glasses of Kalabo decoction and pour into a plastic pail. 3. Mix well by stirring continuously using a wooden ladle or bamboo stick. Use only one direction in mixing the mixture. Stir until the caustic soda is dissolved. 4. Pour 5 glasses cooking oil into the mixture. 5. Continue stirring until a consistency of a condensed milk is achieved. 6. Pour the soap mixture into desired plastic molders. Set aside and let it cool to harden. 7. After 4-5 hours, remove the soap from the molder. 8. Allow 30 days of ageing before packing. Label the soaps. (*businessdiary.com)* Indication: Good in minimizing melanin pigment of the skin, antifungal soap **Science**: select materials and utensils, examine each procedure, and give dos and don'ts in doing the prototype **Mathematics**: cost of the prototype and measurement of each mixture **Engineering and technology**: construct the prototype
6. Test and evaluation of solution	• The teacher and other experts such as representative from the local business department of the barangay and the municipality will evaluate the prototype using the rubric
7. Socialization and completion decision stage	Let the students' present their prototype to the school as a special performance task through the presence of the teachers, the school head and the representatives from the local business department of the barangay or municipality and community leaders and showcase the product. The following details should be included in the presentation: 1. Name of prototype or product 2. Materials used 3. Procedures in crafting the prototype or product 4. Results of the evaluation of prototype or product 5. How the developed prototype or product can help the issue on the essential uses of ethnobotanical plants as well as the issue on undocumented knowledge and skills of these plants that are locally available. After the presentation, critiquing of the prototype or product.

STAGE	ACTIVITY
	Revision of the prototype or product and possible implementation

RUBRIC FOR A PROTOTYPE DEVELOPMENT AND PRESENTATION (HOMEMADE BAR SOAP)

CRITERIA	EXCELLENT (4)	VERY GOOD (3)	GOOD (2)	NEEDS IMPROVEMENT (1)	POINTS
• **MARKETABILITY**					
a. Quality	Very useful and highly necessary	Useful and necessary	useful but unnecessary	Not useful and unnecessary	
b. Appearance	The over-all appearance of the prototype is exemplary attractive to look at	The over-all appearance is not so attractive	The over-all appearance of the prototype is not attractive	The over-all appearance of the prototype is messy and untidy	
c. Price	Affordable my many	Affordable by some	Affordable by few	Not affordable	
• **ORIGINALITY**					
a. color	Vibrant and very pleasing color combination	Pleasing color combination	Less pleasing color combination	Not pleasing color combination	
b. Design	Very unique and authentic	Unique and authentic	Authentic but not unique	Not authentic and not unique	
c. Texture	Very Smooth and pleasant	Smooth and pleasant	Slightly smooth and pleasant	Rough and unpleasant	
d. Scent	Well scented with no foul odor	Less Scented with no foul odor	Fair scented but with a little scent of foul odor	Disgusting smell with very foul odor	
• **PRESENTATION**					
a. Organization and Confidence	Well-organized presentation with high confidence	Not so well organized presentation with high confidence	Organized presentation but less confidence	Poor presentation with no confidence	
b. Audibility	Well-modulated voice	Not so well modulated voice	Tattered voice	Inaudible voice	
				TOTAL POINTS	

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