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Research Article

The instructional design of ethnoscience-based inquiry learning for scientific explanation about *Taxus sumatrana* as cancer medication

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Abstract

The ethnoscience approach is carried out by integrating local wisdom culture in science learning. The Minang community believes that the *Taxus sumatrana* plant is a cancer drug. But they have not been able to explain its benefits conceptually based on scientific inquiry with relevant references. This study aims to solve these problems through (1) designing ethnoscience-based inquiry learning to study the bioactivity of *Taxus sumatrana*; and (2) describe scientific experiments on plants as cancer drugs. This research includes qualitative research to reconstruct scientific explanations based on local wisdom. The data were obtained through observations at the research location regarding community local wisdom and laboratory activities including isolation, phytochemical identification, and chemical structure testing using Perkin Elmer 100 FT-IR spectroscopy. All data obtained were analyzed and corroborated by various relevant sources. The results of the analysis concluded that the appropriate learning design was an integrated model; and secondary metabolites found in the bark and leaves of *Taxus sumatrana* were tested using water, ethanol, ethanol + n-hexane, and ethanol + benzene as solvents, including terpenoids, alkaloids, terpenoids, steroids, phenolics, and saponins. The results showed that *Taxus sumatrana* can act as an anticancer because in the experimental laboratory it is known that terpenoids as taxols, phenolics, and other oxygenated metabolites which have the potential to be anticancer.

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Introduction

Ethnoscience is a set of knowledge that is unique to a community/ethnic group (local wisdom) and is part of the traditions in society, obtained by certain methods and procedures (Fitria, 2018; Sudarmin, 2018). The ethnoscience approach in learning besides preserving the potential and culture of the nation, as well as an effort to improve scientific literacy and thinking skills of students and make students competitive in facing the era of globalization and modernization. In addition, it can also train the awareness and entrepreneurial character of students, so that science learning is more applicable and able to improve the community's economy. Ethnoscience is a way of expressing how science works in society with the integration of Economic of Science (EOS) in Natural of Science (NOS) (Kaya, Erduran, Birdthistle, & McCormack, 2018; Sri Jumini; Sutikno, 2019). One example of ethnoscience-based learning that integrates Natural of Science (NOS) and Economic of Science (EOS) is making anthocyanin chemical batik. Batik

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(Ethno) Anthocyanin The embodiment of chemical batik (A) with the main structure of the anthocyanin (S) found in several local red leaf plants (Ethno). The method of isolation using maceration in a pumpkin (T). This batik utilizes natural dye supplements (E), the price of this batik is IDR 225/piece (M), Figure 1.

Figure 1.
Anthocyanin Chemical Batik

The field of ethno-science studies includes environment (ethnoecology), ethnography, ethnomedicine, ethno-technology, ethnomethodology, and currently developing ethno-STEM.

Likewise for *Taxus sumatrana* as cancer medication which is the focus of local potential in this study. Ethnoscience learning with *Taxus sumatrana* as Cancer Medication is carried out with the stages of a teacher using a scientific approach so that there are stages of science reconstruction, namely observation to collect data on public knowledge about *Taxus sumatrana* as cancer medication, verification and reduction of knowledge, conceptualization and validation, after that true, integrated in learning, namely in teaching materials and student worksheets. Learning like this is not only closer to the environment of the students, so that learning is more meaningful, students are also able to develop business opportunities for economic development by producing *Taxus sumatrana* as cancer medication (Earle, 2013; Khory, 2019).

Cancer is an awful scourge for everyone. Generally, cancer defines as a disease of the cell cycle that is characterized by an increased ability of cells to grow out of control and attack nearby cell tissue, then migrate through the process of metastasis (Hidayat, 2014; Yuliana & Hidayat, 2017). Cancer mortality rates rank the second for the world scale and third for the Indonesian scale (Dhama, 2013; Graffigna, Vegni, Barello, Olson, & Bosio, 2011a). As an effort to treat cancer; The United States, through the National Cancer Institute (NCI), formed a special institution called the Cancer Chemotherapy National Service Center (CCNSC) in 1956. The institute is a research support institution in the discovery of anticancer drugs from plants of the United States (Hidayat, 2013; Khory, 2019). Through a long journey, in 1972, a group of plants belonging to the Taxus genus was identified to contain anticancer bioactive known as paclitaxel with the trademark of 'Taxol'. At that time, Taxol was extracted from a species of Taxus brevifolia Nutt, which was found in the mountainous areas of North Western, United States, and Western Canada (Farrar, 1995).

As for in Indonesia, several studies regarding Taxus as anticancer medicine have been conducted and revealed that almost all parts of the Taxus contain anticancer bioactive. In Asia, several countries have a natural distribution of diversity of the Taxus genus involving *Taxus cuspidata* (Japan), *Taxus chinensis* (China), and *Taxus sumatrana* (Indonesia, Taiwan, Vietnam, Nepal, and Tibet). Nevertheless, the population of Taxus is prone to extinction (Huang et al. 2008). Rahmat (2008) explained that the Taxus' natural habitat in Indonesia is currently in the Mount Kerinci region, Jambi, namely on the ridges, steep slopes, and cliff edges. In addition to Jambi, the distribution of some regions (Rahmat, 2008). Sumatrana population is also found in the Sibuaton Dolok Protected Forest, Pagar Alam, Palembang (Earle, 2013).

Indonesia is one of the countries that has the most extensive tropical forest land in the world (Matsjeh, 2009). The existence of tropical forests implies that Indonesia has a mega diversity for medicinal plants (Achmad, 2009). *Taxus sumatrana* (local: Sumatran yew) is an essential plant for Minang society, one of the ethnic groups native to West Sumatra. They have long believed that some parts of the yew tree are effective cancer cure. Several studies have taken a look at this case from ethnomedicine and ethnopharmacology point of view (Hakim, 2014; Mondaya, 2019). Ethnomedicine is the perception and conception of local communities in understanding health or studies that discuss traditional medical systems (Bhasin, 2017). Ethnomedicine studies are conducted to understand health culture from the viewpoint of society to be reconstructed into scientific knowledge. On the other hand, ethnopharmacology is the study of the use of plants that have pharmacological effects that have a relationship with the treatment and maintenance of health by certain communities (Manar, 2018; Walujo, 2013).

A learning model concerning the bioactivity of the Taxus' secondary metabolite compounds has not been developed so far, and so for the scientific explanation of the plant as anticancer. For that reason, this study intends to provide answers to these two problems. In doing so, a series of lab experiments were carried out including isolation, phytochemical test, and structure test. Local wisdom about tropical forest plants as a cancer drug in Indonesia is well-believed. For instance, Minang people who convince that yew (*Taxus sumatrana*) tea is good to treat cancer. They usually dry the bark or leaves then brew it (Ahmad Khoiri, 2019; Fasasi, 2017). At a certain level, this belief might be a true, yet scientific explanation, as well as the preservation of the plants, should be informed to them and this is the concern of this study.

The need to reconstruct people's indigenous knowledge is known as the reconstruction of scientific knowledge (Sudarmin, 2019). Other studies on this matter have generated evidence of the truth of a certain plant's medicinal benefits, which become the basis of massive production by the pharmaceutical industry. The examples of drugs circulating in the community which was derived originally from indigenous knowledge are quinine as a malaria remedy; reserpine from Indian Rauwolfia serpentine as a blood pressure medication.

Another arising problem is a gap between public knowledge about traditional medicine with scientific knowledge in the academic community. Therefore, this research was divided into two parts; the first was to reconstruct and explain why Taxus can hinder cancer cells. The second part carried out isolation and extraction process, phytochemical test, and structure test of *Taxus sumatrana's* to hypothesize the association of secondary metabolite compounds with their bioactivity as inhibitors of cancer cells. As for this research, scientific explanation referred to the conceptual framework developed by Hempel (2014).

Problem of Study

Ethnoscientific learning to provide a scientific explanation of *Taxus sumatrana* as Cancer Medication needs to be done. This research was conducted to answer several problems as follows:

- How is the instructional design of science learning that integrates the scientific explanation of the *Taxus Sumatarana* plant as a cancer medicine?
- How should activities be prepared in ethnobiological teaching design with an endemic plant investigated for cancer medicine?

By answering the problem through this research, it is hoped that this research will be able to contribute knowledge in making innovations in science learning (Shen et al. 2005).

Method

Research Model

This research belongs to a qualitative study followed by experiments. The ethnoscience approach (Sudarmin, 2018; NRC, 2011; Sumarni, Wardani, Sudarmin, & Gupitasari, 2016) was used to reconstruct and explain the scientific knowledge based on the indigenous belief about *Taxus sumatrana* as a cancer drug. The performed experiments consisted of isolation and extraction, phytochemical test, and structure test. Ethno-scientific Instructional Design is carried out by observing the original scientific stages of the community, then being taken to the laboratory to prove scientifically.

The Design of Ethnoscience-based Inquiry Learning

The researchers studied various inquiry and integrated models referring to (Fogarty, 1991) and resulted in the following model as presented in Figure 2 which integrates inquiry with ethnoscience.

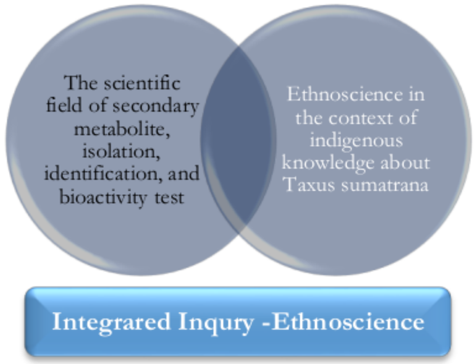

Figure 2.
The Integrated Model for Inquiry and Ethnoscience (Sudarmin, 2018)

The ethnoscience and STEM integrated inquiry learning model refers to one of the Robbin Forgarty (Priscylio & Anwar, 2019) integrated models whose integration pattern is through a pattern as shown in Figure 3.

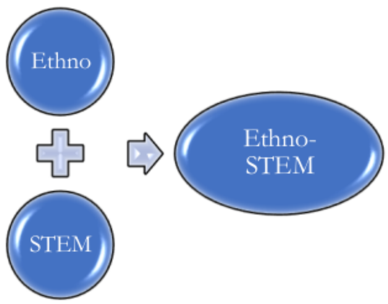

Figure 3.
The Integrated Model for Inquiry and Ethnoscience

Procedure

The Isolation of Taxus Sumatrana Bark and Leaves

The powder of the bark sample was divided into two, one for the extraction process and the other for the isolation process. The sample was extracted through the maceration method by soaking the sample in water. The stirring and water replacement was done every 24 hours then the mixture was filtered using filter paper. Next, the maceration result was evaporated using the 121 OBV-W Rotary Evaporator at 100°C. The remaining filtrate was evaporated in Waterbath, so thick extract of *Taxus sumatrana* was obtained. As for the isolation, the soxhletation method was used with ethanol, ethanol + benzene, and ethanol + hexane solvent. The soxhletation lasted for about 48 hours, and the result was put into the rotary evaporator at 100 °C. The extractant obtained as a result of evaporation was subjected to phytochemical test and structure test.

The Phytochemical Test

The procedure of this phytochemical analysis uses the Sudarmin et al. (2020) which, in the phytochemical tests consisted of several. First, alkaloids identification using Mayer and Dragendorf reagent. The Mayer reagent was added to the isolate, if a foggy white deposition is formed then it is alkaloids-positive. On the other hand, the isolate is declared alkaloids-positive if orangey-red sediment is formed when the Dragendorf reagent is put on. Second, steroids and terpenoids identification using Liberman Buchard's Test. At the end of the test, if the isolate is red or purplish red, then it contains terpenoids. If the isolate is green or bluish-green, then it contains steroids. Third, the flavonoids test by putting several drops of the isolate fraction water in a reaction tube. Mg powder and several drops of potent HCl are also added in it. If the mixture is pink to red (except for isoflavones), then it is declared flavonoids-positive. Fourth, phenolics identification by putting several drops of the isolate fraction water in a reaction tube, then FeCl3 is added. If the mixture turns blue or purplish-blue, then it is phenolics-positive. Fifth, saponins identification in which

1mL of water fraction is put into a reaction tube then shaken for 1-2 minutes. If the permanent foam is formed (which lasts for about 5 minutes), then it is declared saponins-positive.

The Structure Test Using Perkin Elmer 100 FT-IR Spectroscopy

FT-IR is a tool to analyze chemical compounds that shows the existence of a functional group of the organic molecule, which in this case, is the metabolite compounds (Dachriyanus, 2004). The sample of *Taxus sumatrana* was prepared in a NaCl specimen. The specimen was put in a sample stage and the measure button was clicked. After a while, the spectra description could be seen in the monitor.

Research Location

This research was conducted in Mount Kerinci, Jambi Province, Indonesia. The area is 53435.72 km^2. It consists of 51,000 land, 425.5 oceans. Geographical location 0^0 45" -2^0 45" south latitude, and 101^0 10" -104^0 55" minutes east longitude. North boundary: Riau province. South: South Sumatra. In the west with the West Sumatra Province. East by the South China Sea. The research location can be seen on the following map.

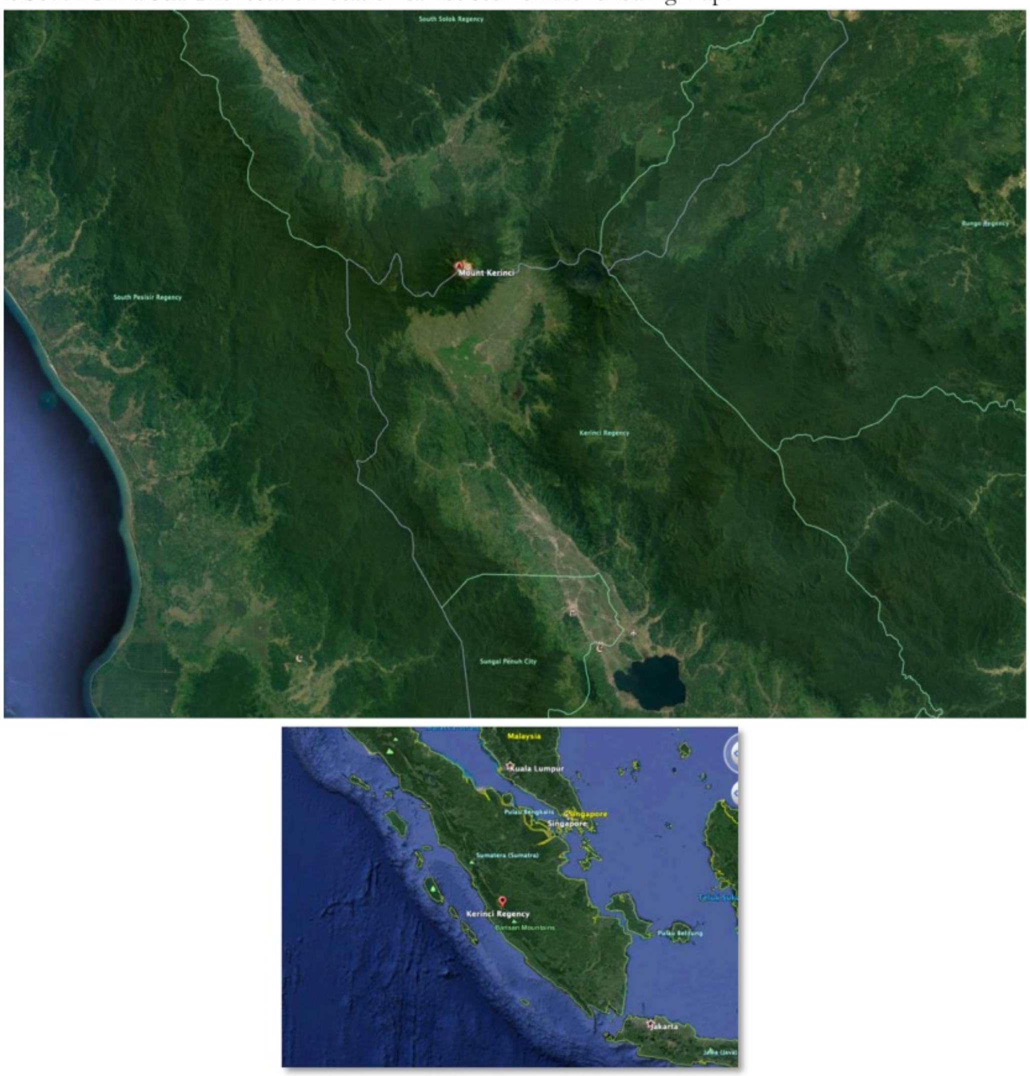

Figure 4.

Map of Research Place: Mount Kerinci (Google Earth)

Data Analysis

The qualitative data are described qualitatively while the lab work results are explained and analyzed scientifically to provide proper elucidation of the research problems. Interviews with people living in that region were analyzed using an ethnoscientific approach. The semi-structured interview was presented with content analysis. The instructional design suitable for the Ethnoscientific approach is presented in stages with the models in the relevant literature. Expert opinions were consulted in terms of compliance with the models in the formation of the instructional design. Thus, attention was paid to the formation of accuracy and reliability features of qualitative research (Yin, 2016).

Results

The scientific field discusses the secondary metabolite compounds and their classification, isolation, extraction, phytochemical identification, and structure test. Besides, the health benefits and paper related to *Taxus sumatrana* was also discussed. On the other hand (the right bubble), the people's indigenous knowledge is talked about deeply. The questions proposed followed Hakim', (2014) ethnobotanical research procedure concerning local name, plant characteristics, health benefits, ways to consume, and the reason underlying the health benefits.

The middle part depicts the integration of inquiry (left bubble) and ethnoscience (right bubble) in which students are asked to carry out scientific lab work primarily in preparing the tools and materials for the isolation and extraction process, as well as phytochemical and structure test. These preparations follow Supartono et al. (2016).

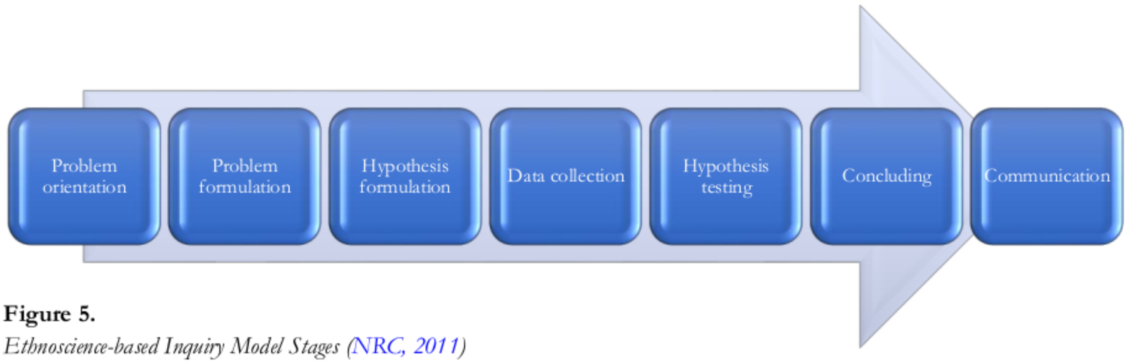

Figure 5.
Ethnoscience-based Inquiry Model Stages (NRC, 2011)

The ethnoscience-based inquiry model has seven stages at Figure 3, which consist of problem orientation, problem formulation, hypothesis formulation, data collection, hypothesis testing, concluding, communicating research results. The seventh stage is the supplementary phase based on the National Research Council (NRC, 2011).

The Reconstruction of Scientific Knowledge Based on People's Indigenous Belief

Upon using the ethnomedicine approach, observation and interviews were carried out. The source person is Agustinus H (45 years) from Padang and Karyanto (25 years) from Jambi, Indonesia. The observation pictures (with permit see Appendix 1) are collected in the following Figure 6. The two speakers conveyed the similarity of knowledge, namely the local name of the Taxus and the way people consume it. The process of boiling Taxus bark/leaves, in the context of scientific knowledge, is called the maceration process (Sudarmin, 2020). The change in color of the Taxus water indicates the presence of secondary metabolite compounds that are dissolved in water.

Research Team

Taxus sumatrana tree

Taxus tea

Taxus tea

Figure 6.
Ethno-scientific Learning Process with

The interview results with the two source persons are presented in Table 1.

Table 1.
Summary of Interview Results

No	Question	Answer	
		Refi Agustinur H (45 years) Location: Luhung tanjung, Pandai Sikek, Kec. X Koto Tanah Datar, Singgalang	**Karyanto (25 years)** Location: Sungai Penuh Gunung Kerinci Jambi
1	Local name	Sumatran yew (*Taxus sumatrana*)	Sumatran yew (Taxus)
2	Characteristics (leaf, wood, flower, seed, etc.)	Small leaves growing to the left and right. They are light to dark green in color. Hard, woody, and scaly stem. The bark is reddish-brown Seeds are outside and inside the fruit.	Leaves: jagged like cycad leaves Bark: scaly. Flowers and seeds: never seen before Leaf color: dark green
3	Benefits	As a cancer drug and tumors, especially breast and prostate cancer.	Trusted as a cancer drug
4	Parts of plant having medicinal advantages	Bark and leaves	Bark and leaves

5	The way people consume it	Wash the leaves and bark, dry them under direct sunlight. Once dried, grind using blender or brew with hot water to result in Taxus tea.	Taxus bark is consumed as a tea.
6	The recipe of Taxus as medicine	1. Puree the leaves using a blender 2. Every one tablespoon of leaves, add 4-6 liters of water. 3. Heat until the color of water resembles the color of tea. 4. The herbal extract is ready to serve.	Boil ± 10 cm of Taxus bark in 2 glass of water and drink it.
7	The reason behind its medicinal advantages	Taxus contains a chemical compound named Taxol.	No idea

Taxus sumatrana belongs to the Plantae Kingdom, Pinophyta Division, Pinopsida Class, Pinales order, Taxacease Family, Taxus Genus, and *Taxat sumatrana* Species (Mondaya, 2019). Based on literary and reference sources, it is known that *Taxus sumatrana* or Sumatran yew grows in humid subtropical forests and mountain rain forests at an altitude of 1,400-2,800 m above sea level (NRC, 2011; Richard Decaprio, 2017). This type of natural distribution is reported in the Philippines, Vietnam, Taiwan, China, and Indonesia (Artanti, 2002). In Indonesia, *T. sumatrana* grows naturally as a sub-canopy in mountain forests or mountain ridges on the islands of Sumatra and Sulawesi (Spjut, 2007). The results of a direct field survey conducted as (Shen et al. 2005) show that the natural habitat of Sumatran fir in Indonesia currently exists in the Mount Kerinci region, Jambi. This species grows naturally as a sub-canopy in mountain forests on ridges, steep slopes, and cliff edges at an altitude of 1,700-2,200 m above sea level. The spreading pattern of *Taxus sumatrana* growing on Mount Kerinci has a similarity of those in Taiwan. Its leaves are elliptical-shaped, olive green in color with a length of 1.8-3.0 cm, a width of 2.0-2.5 mm, and a thickness of 200-275 μm. The color of the bark is grayish red with a thickness of 0.5–0.8 cm. The male coneflower is usually not seen, whereas female coneflowers are subcylindrical with a length of 2 mm and a width of 1 mm. The bark, leaves, branches, twigs, and roots of the Taxus species, including *T. sumatrana*, are a source of Taxane, namely paclitaxel extracted as a very successful drug used in chemotherapy for various types of cancer. Kitagawa (1995) and Shen et al. (2005) reported that *T. Sumatrana* bark derived from Mount Kerinci contained 10-deacetylbaccatin III and baccatin III. Both of these compounds are intermediate products (precursors) of the Taxol® biosynthesis. 10-deacetylbaccatin III and baccatin III are also found in young leaves and stems of *Taxus sumatrana*. The results of other literature searches revealed that Taxus contains bioactive compounds as anticancer which are put up in Table 2.

Table 2.

Bioactive Compounds in Taxus Sumatrana

No	Part of plant	Active compound	Reference
1	Leaf	*Paclitaxel* (0,006%)	Kitagawa et al. (1995)
		Baccatin III (0,02%)	
		Taxane diterpenes ester group	Shen et al. (2005)
2	Bark	*Baccatin* II dan 10- *deacetylbaccatin* III (10- DAB	Hidayat & Tachibana, (2013)

Table 2 shows that one of the secondary metabolites compounds potential as anticancer is paclitaxel, a very complex group of diterpene compounds obtained from the extraction of part of the Taxus. The chemical nomenclature for paclitaxel is 5β, 20-epoxy-1,2 α, 4.7 β, 13 α - hexahydroxytax-11-en-9one-4, 10-diacetate-2-benzoate 13 esters with (2R, 3S) -N-benzoyl-3-phenylisoserine (Ghafoori, 2012; Lung-Guang, 2019).

The Scientific Explanation of the People's Indigenous Belief through Laboratory Research

A series of laboratory work was performed to provide a scientific explanation to the people's indigenous beliefs regarding Taxus sumatrana as anticancer medication. The lab work consisted of isolation, phytochemical identification, and structure test of the Taxus' secondary metabolite compounds. The isolation process was done through the soxhletation method with an organic solvent and maceration process. After the soxhletation and maceration were done, the evaporation process was carried out to vaporize the water and organic solvent, leaving the extract of *Taxus sumatrana* as shown in Table 3.

Table 3.

The Characteristics of Substances from Taxus Sumatrana Extract

No	Sample	Treatment	Characteristics of substances (organoleptic)
1	Bark	Soxhletation using ethanol as solvent	Light orange liquid
		Soxhletation using ethanol + *n*-hexane as solvent	Dark orange liquid
		Maceration using water as the solvent	Light yellow liquid
		Soxhletation using ethanol + benzene as solvent	Yellow liquid
2	Leaf	Soxhletation using ethanol as solvent	Light orange liquid

After having organoleptic testing of the studied sample, phytochemical tests were carried out and the results are presented in Table 4.

Table 4.

Phytochemical Test Results of Taxus Sumatrana Bark and Leaf Extracts

No	Sample extract	Solvent	Alkaloids		Steroids	Terpenoids	Phenolics	Saponins
			Mayer	Dragendorft				
1	Bark	Water	-	-	-	+	++	++
2	Bark	Ethanol	+	+	-	+	+++	+++
3	Bark	Ethanol and hexane	-	-	-	+	++	-
4	Bark	Ethanol and Benzene	-	-	+	-	+	-
5	Leaf	Ethanol	-	-	+	-	+	-

The phytochemical test results revealed that both in the bark and leaves of *Taxus sumatrana* extract contains phenolics. Alkaloids are only found in the bark-ethanol mixture. Further, other compounds found include steroids, terpenoids, and saponins. The existence of these metabolites, which explains scientifically why Taxus extracts could be an anticancer agent, this following the findings of Shen' et al. (2005). Based on the displayed data, the main ingredients in *Taxus sumatrana* as an anticancer compound are terpenes and phenolics. The medical team of Lambung Mangkurat University (Mangkurat, 2017) stated that phenolics are very potential as an anti-cancer. To strengthen the phytochemical test results, the structure test was done using Perkin Elmer 100 FT-IR Spectroscopy and showed the absorption of hydroxyl and carbonyl group, aromatic rings, as well as methyl and methylene group. The FT-IR spectra results are presented in Figures 6 and 7.

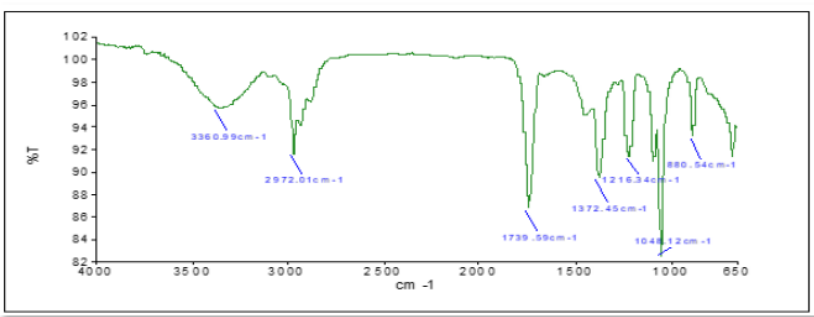

Figure 5.

The Spectra Results of Taxus Sumatrana Leaf Extract with Ethanol Solvents

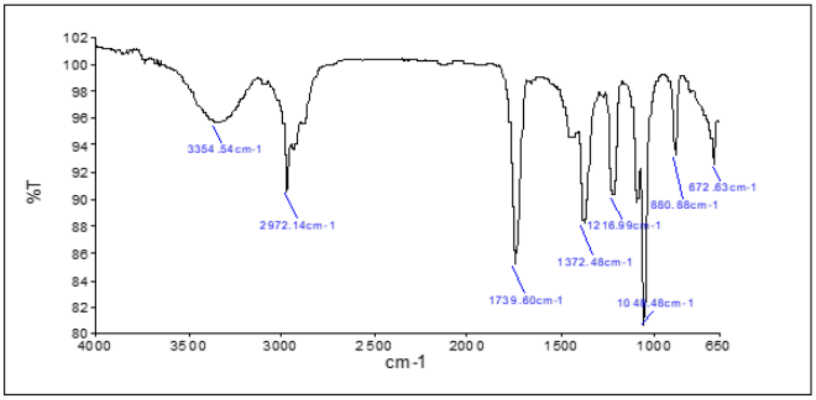

Figure 6.

The Spectra Results of Taxus Sumatrana Wood Extract with Ethanol + Hexane Solvents

Based on the FT-IR Spectra data from Figure 5 to 6, the functional group in *Taxus sumatrana* can be summarized in Table 5.

Table 5.

The Absorption of Functional Groups from Taxus Sumatrana Extract Samples

No	Wavenumber (cm^{-1})	The Functional Group Absorption Type
1	3354 - 3500	Absorbance for hydrosol functional groups (-OH)
2	2972-2975	Absorbance for alkane group vibrations for $-CH_3$, $-CH_2-$ from alkanes/aromatics
3	1734 - 1740	Typical absorption for carbonyl groups (C = O)
4	1217 - 1225	Vibration from the presence of a carbonyl group (= CO) of an ester, carboxylate, or acid anhydride
5	1000 - 1040	The presence of C = C – H, and aromatic H-H from phenolic compounds

The findings of the FT-IR test data have strengthened the results of this research and people's indigenous belief about the Taxus as anticancer. Secondary metabolite compounds act as anticancer due to the presence of oxygenated functional groups as bioactive groups inhibiting the growth of cancer cells (Artanti, 2002).

Discussion and Conclusion

The results of the analysis of several reputable international articles on ethnoscience reveal several things related to ethnoscience related to the environment. Ecology related to school location has a significant effect on students' attitudes towards science, the use of traditional science in learning must continue to be explored (Fasasi, 2017). Cultural diversity has been used to develop approaches in science learning (Zidny & Eilks, 2020). Science learning needs to be directed at the environment around students, so that it is more real, not just theory. Science knowledge is constructed by students through facts, phenomena and events in the surrounding environment. The culture that occurs in the community around students has also begun to be integrated into many science learning. It is also very good at dealing with cultural disintegration. The separation between science and community culture can be overcome with an ethnoscience-based learning approach. Thus science learning will be more visible how to work in the community (Jumini, 2016). Ethnoscience-based science learning embodies the function of education in preserving positive cultural values, and creating changes towards a more innovative life (Sudarmin, Sumarni, Zahro, Diba, & Rosita, 2018). Ethnoscience leads public science into scientific science, so that learning will be more meaningful.

Ethnoscience-based learning in ethnobiology has also been carried out by integrating community culture in learning. Research results have documented the importance of understanding traditional artisanal knowledge of fishermen about cetacean fish interactions (Zappes, Simões-Lopes, Andriolo, & Di Beneditto, 2016). The artisanal effects of dolphin fishing can be reduced by the negative effects based on public knowledge. People's culture has a lot of knowledge and is articulated in the knowledge of the universe (Weiskopf, 2020). Ethnobiology aims to find ways to integrate public knowledge with scientific knowledge produced by academics. Thus, biological knowledge whose learning is integrated with traditional community knowledge will be more beneficial, as well as its role in solving problems that exist in society. The *Taxus sumatrana* plant as one of the plant species in the Sumatran region that is believed by the community and proven to be a cancer medicine is integrated in learning so that public science becomes scientific science that enriches scientific knowledge and preserves local wisdom.

Ethnolinguistics related to ethnolinguistics related to local languages encourages a process of scientific explanation of local languages. Ecolinguistics studies various linguistic phenomena from a uniform perspective. The environment influences culture, and ecology is a sign in general, not only of language (Do Couto, 2014). Local languages which reflect local culture and constitute social science are translated into scientific language so that they can translate scientific knowledge contained in the culture of society into scientific knowledge. Local regional languages that sometimes limit local cultures and wisdom to be understood globally. For this reason, the role of ethnolinguistics is very large so that public knowledge contained in integrated local wisdom is generally understood to become scientific knowledge that can be accepted by all circles. Likewise with the *Taxus sumatrana* plant which is the focus of this research (Earle, 2013; Guang-li, 2010).

Etnomedicine explains local wisdom that can be used in medicine and its scientific explanation is carried out in research-based learning in the laboratory. The manufacture of traditional medicine from local plants contributes better to the local medical system (Roumy et al. 2020). From this research, it was found that local plants are efficacious for treating hepatitis. Learning that explores local plants will provide insight into how science works to provide solutions to problems in society. Likewise, the *Taxus Sumatrana* plant is believed by the public and is proven to be a cancer medicine (Graffigna, Vegni, Barello, Olson, & Bosio, 2011b; Kirshbaum, Olson, Pongthavornkamol, & Graffigna, 2013).

Taxus sumatrana is an example of a local plant that can treat and prevent cancer. Ethnoscience is carried out to explore this plant so that it is known the relationship between public science and scientific science. Ethnoscience is an innovative approach that provides insight into how people experience and understand their illness (Graffigna et al. 2011b). Meanwhile, ethnomedicin is a branch of medical anthropology that discusses the origin of disease, causes, and methods of treatment according to certain groups of people. The experience of sufferers in care and healing is influenced by the cultural background in which they live. Likewise, the *Taxus sumatrana* plant is effective in treating cancer.

The exploration of *Taxus sumatrana* gardens in chemistry learning is able to explain public science into scientific science which not only enriches scientific knowledge, but can also provide a production stimulus from the benefits of this plant in cancer treatment. Thus not only a scientific attitude is formed in learning, but also entrepreneurial character can be grown. This is what encourages this research to be carried out. The people believe that *Taxus sumatrana* plant has been proven to cure cancer. It's just that scientifically there is no complete explanation yet. Several studies have not explained the scientific knowledge of the public about this *Taxus sumatrana* plant. Therefore this study does several things, the first is regarding the ethnoscience of the *Taxus sumatrana* plant by means of interviews, the process of verification and data reduction, followed by conceptualization and implementation in organic chemistry learning. Second, a scientific explanation process is carried out related to phytochemical tests, structural tests, and anti-bacterial tests to show that the public's knowledge of the *Taxus sumatrana* plant can be scientifically proven through experimentation in the laboratory.

Thus it can be found the types of compounds that have the potential as anti-cancer drugs. This compound is also studied for its structure, and how its activity is as anti-bacterial. The discovery of this anti-cancer bacterial compound is very important, as a basis for further testing of how its activity as an anti-cancer. The results of this study serve as the basis for continuing the scientific testing process regarding the medicinal plant *Taxus sumatrana* which the public has not explained scientifically. This is the importance of this research being conducted. The results of research on the *Taxus sumatrana* plant that are integrated in learning will enrich local potential-based scientific knowledge.

The analysis concluded that; the resulted learning design is the ethnoscience-based inquiry learning; the secondary metabolite compounds found in the bark and leaf of *Taxus sumatrana* include terpenoids, alkaloids, terpenoids, steroids, phenolics, and saponins; the structure test unveiled the presence of secondary metabolite compounds and is strengthened by absorption bands of hydroxyl groups, carbonyl, C-O stretches, and aromatic rings on FT-IR spectra. These findings indicate that *Taxus sumatrana* can act as an anticancer, because terpenoids, phenolics, and other oxygenated metabolites have potential as anticancer. Thus, ethnoscience-based inquiry learning design has succeeded in explaining science related to public science with scientific science for scientific explanation of *Taxus sumatrana* as a Cancer medicine.

Recommendations

Ethnoscience instructional design with taxus sumatrana as cancer medication in sci ence learning using an integrated inquiry approach Sudarmin's (2018) Ethno-STEM model is very well applied in ethnoscience integrated inquiry-based science learning. Need to be applied to other learning. Syntax of the Sudarmin (2018) model, namely present, performance, discussion, analysis, solidification, implementation and value or evaluation. Learning activities begin with an analysis of core competencies (CI)/basic competencies (CB), especially CB 3 and 4, then compiled indicators, learning objectives, then compiling an integrated Semester lesson plan, followed by the implementation of Semester lesson plan in learning through an integrated ethno and stem inquiry approach Sudarmin' (2018) stages. Sudarmin's (2018) inquiry stage makes students active and constructs their knowledge by integrating people's knowledge into scientific knowledge. Learning experiences like this will further hone students' thinking skills and provide concrete examples of how science works in society. Thus learning will be more meaningful.

Limitations of the Study

Research limitations should also be considered for further research. This study only investigated the Taxus Sumatrana plant in the Sumatra area as Cancer Medication. It is possible that there are other plants in this area that can also be used as cancer medicine. In addition, it should be noted that the background and number of informants at the time of collecting the selected data were different for further research. In addition, the Sudarmin (2018) learning syntax still needs to be simplified.

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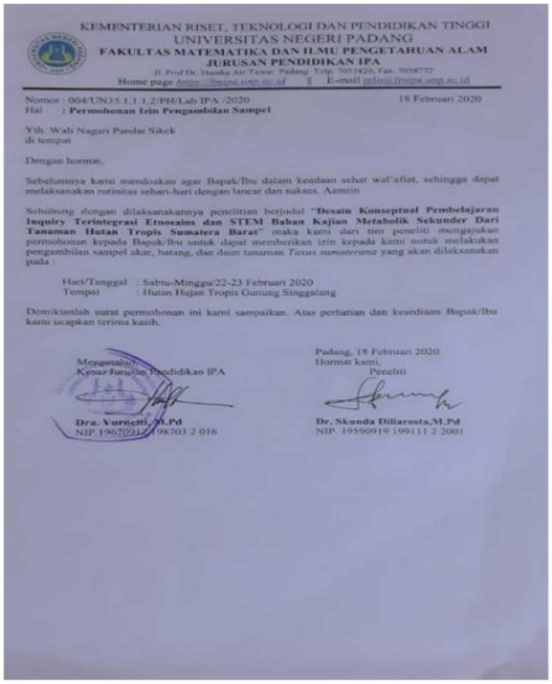
Appendix 1.

Observation Permit for Science Education Students of UNP Padang



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Nomor : 004/UN35.1.1.1.2/PH/Lab IPA /2020 — 18 Februari 2020
Hal : **Permohonan Izin Pengambilan Sampel**

Yth. Wali Nagari Pandai Sikek
di tempat

Dengan hormat,

Sebelumnya kami mendoakan agar Bapak/Ibu dalam keadaan sehat wal'afiat, sehingga dapat melaksanakan rutinitas sehari-hari dengan lancar dan sukses. Aamiin

Sehubung dengan dilaksanakannya penelitian berjudul "**Desain Konseptual Pembelajaran Inquiry Terintegrasi Etnosains dan STEM Bahan Kajian Metabolik Sekunder Dari Tanaman Hutan Tropis Sumatera Barat**" maka kami dari tim peneliti mengajukan permohonan kepada Bapak/Ibu untuk dapat memberikan izin kepada kami untuk melakukan pengambilan sampel akar, batang, dan daun tanaman *Taxus sumaterana* yang akan dilaksanakan pada :

Hari/Tanggal : Sabtu-Minggu/22-23 Februari 2020
Tempat : Hutan Hujan Tropis Gunung Singgalang

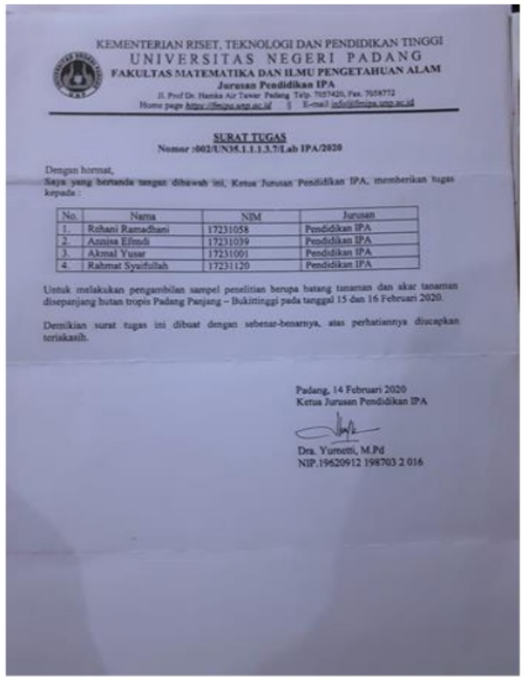
Demikianlah surat permohonan ini kami sampaikan. Atas perhatian dan kesediaan Bapak/Ibu kami ucapkan terima kasih.

Mengetahui,
Ketua Jurusan Pendidikan IPA

Dra. Yurnetti, M.Pd
NIP.19620912 198703 2 016

Padang, 18 Februari 2020
Hormat kami,
Peneliti

Dr. Skunda Diliarosta,M.Pd
NIP. 19590919 199111 2 2001



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SURAT TUGAS
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Dengan hormat,
Saya yang bertanda tangan dibawah ini, Ketua Jurusan Pendidikan IPA, memberikan tugas kepada :

No.	Nama	NIM	Jurusan
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2.	Annisa Efendi	17231039	Pendidikan IPA
3.	Akmal Yusar	17231001	Pendidikan IPA
4.	Rahmat Syaifullah	17231120	Pendidikan IPA

Untuk melakukan pengambilan sampel penelitian berupa batang tanaman dan akar tanaman disepanjang hutan tropis Padang Panjang – Bukittinggi pada tanggal 15 dan 16 Februari 2020.

Demikian surat tugas ini dibuat dengan sebenar-benarnya, atas perhatiannya diucapkan teriakasih.

Padang, 14 Februari 2020
Ketua Jurusan Pendidikan IPA

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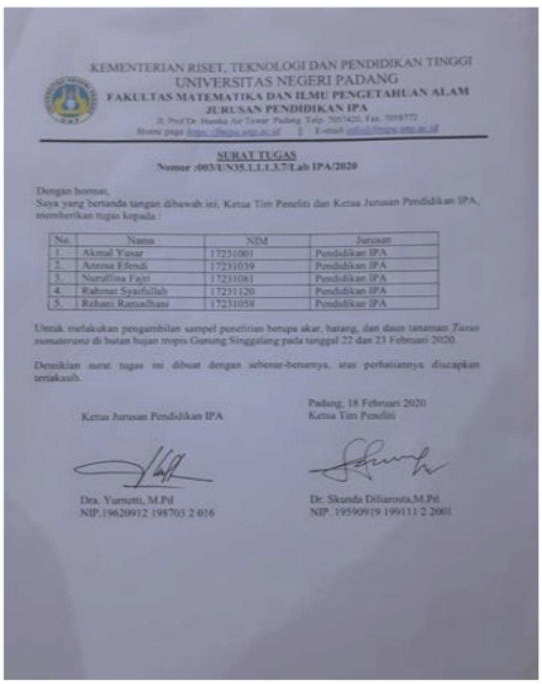

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4.	Rahmat Syaifullah	17231120	Pendidikan IPA
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Untuk melakukan pengambilan sampel penelitian berupa akar, batang, dan daun tanaman *Taxus sumaterana* di hutan hujan tropis Gunung Singgalang pada tanggal 22 dan 23 Februari 2020.

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