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Identification of Ethnoscience in Peringgesela Weaving as a Learning Resource for Environmental Chemistry

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Abstract: In the context of environmental chemistry learning, ethnoscience can be used to connect scientific concepts with cultural values. This learning helps students understand the importance of environmental conservation through a relevant and contextual approach. This study aims to identify the ethnoscience of Peringgesela weaving as a learning resource for Environmental Chemistry. The subjects of this study were Peringgesela weaving craftsmen. The research methods were observation, interview and documentation. The results showed that natural dyes such as tarum, mengkudu, and turmeric contain active compounds that represent chemical concepts such as redox reactions, acid-base, and extraction. In addition, the fixation process using synthetic fixation materials such as alum with the molecular formula $KAl(SO4)_2$, lime $Ca(OH)_2$ and tunjung (FeSO4) with waste that is directly disposed of in the surrounding waters. The absence of waste management shows the basic principles of environmental chemistry. The integration of ethnoscience in learning resources for Environmental Chemistry allows students to understand science concepts more contextually, relevantly, and deeply.

Keywords: Environmental Chemistry; Ethnoscience; Learning Resources; Peringgesela Weaving.

Introduction

Indonesia has a variety of cultures and customs spread throughout the region. Cultural diversity can be influenced by different geographical factors such as people who live in the mountains, coasts, lowlands and highlands. Based on BPS data in 2013, Indonesia has more than 633 large tribes. Each tribe has its own local wisdom in the form of a view of life, knowledge and life strategies related to solving problems and fulfilling daily needs.

Local wisdom, in addition to being conceptualized as local genius, can also be conceptualized as local knowledge because local wisdom is rooted in a knowledge system. Local wisdom that is conceptualized as local knowledge is interpreted as local knowledge. Local knowledge is unique knowledge possessed by a particular society or culture that has developed over a long time as a result of reciprocal relations between society and its environment. Local knowledge is the fruit of the thoughts/ideas of the local community that have good value. Forms of local wisdom can be in the form of views on life, values, norms, ethics, beliefs, customary laws, customs, and special rules that are usually symbolized in myths and rituals [1].

Changes in the Environmental Chemistry learning process are very important to improve students' critical thinking and environmental literacy. The learning evaluation process shows that students are still less able to work on a project for analyzing and solving environmental problems [2]. In this situation, students need a more creative process, learning resources and learning models. Learning resources are expected to be representative of current conditions. Innovation in learning resources is a fundamental issue for improving the quality of education, so that the learning process is expected to follow the development of science and technology [3-4].

Environmental chemistry aims to develop student competencies consisting of: attitude competency, knowledge competency, general skill competency, and specific skill competency related to the environment, so that teaching materials (e-modules) are needed that are integrated with community customs (ethnoscience). Integration of ethnoscience in learning is very important, because current conditions, existing values and norms are often ignored, especially those related to the environment [5].

Local cultural values in Indonesia have been displaced by the current of globalization. Values from outside are developing rapidly in people's lives and have an impact on the environmental balance. The concepts of scientific knowledge are the main goal of the current learning process, and forget the culture of the local community [6]. Ethnoscience is rarely integrated with the curriculum, learning tools and in the preparation of teaching materials [7]. The results of research in the field of chemistry that raise local culture are only 1.7% [8].

Learning that integrates ethnoscience and scientific knowledge has been developed in several countries to determine the impact of the material being studied so that

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students can understand the material through the use of their surrounding environment [9]. Ethnoscience is indigenous knowledge (indigenous science) of a particular community, which is related to the cognitive map of a society [9-10]. Ethnoscience-based learning is in accordance with the conditions of the Indonesian nation. Learning that is relevant to culture and responsive to culture can be a solution to meet the needs of the nation's growing diversity [11]. Ethnoscience-based learning trains students to observe a culture, including observation, interviews, and even literature analysis on the native culture of the surrounding community [12]. One of the ethnosciences on the island of Lombok that can be integrated into learning resources is Tenun Peringgesela.

Weaving (*Sesek*) Peringgasela is a traditional Indonesian woven craft originating from West Nusa Tenggara and has been designated by the Directorate of Heritage and Culture as an intangible cultural heritage of Indonesia in 2018, with the domain of Traditional craftsmanship and crafts culture. Woven cloth from the village of Peringgesela, East Lombok, is one of the national cultures that has its own uniqueness, which is taught from generation to generation, as well as materials and coloring processes from nature. This woven cloth is used in social activities and rituals. Almost all mothers in the village of Peringgesela can weave and are cultured in the social life of their community. The weaving process uses traditional tools (Gedogan), whose sound can be heard from a distance when they are weaving on the terrace of the house. The sound heard is sek sek, so that the *Sasak* woven cloth is also termed *sesek* cloth.

This Peringgesela woven cloth is widely known, not only in Indonesia but also in many countries, such as Japan, which specifically comes to learn how to make woven cloth. Until now, Peringgesela woven cloth still maintains the naturalness or authenticity of the weaving. The dyeing of the yarn used still uses natural materials such as leaves, stems and roots from plants in the surrounding area. This study aims to identify ethnoscience values in Peringgesela weaving practices and explore the potential for their integration in the contextual learning of Environmental Chemistry. Chemistry learning has often been seen as abstract and detached from real life.

Research methods

This type of research is qualitative descriptive, using a case study approach. A case study is an empirical method that investigates contemporary phenomena in depth and in a real context [13]. This study uses two techniques, namely observation and interview techniques. Observations were conducted to directly find out the phenomenon being studied. Interviews were conducted with several respondents to obtain information about the lomang making process, which was carried out in Peringgesela Village, Suela District. East Lombok Regency. The subject of the study was Mr. Maliki as a Peringgesla weaving craftsman. Observation data includes the process of dyeing, soaking, fiber processing, and waste management. Interviews were conducted to explore the cultural meaning and scientific processes that they understand locally. Data were analyzed using thematic analysis techniques by linking field findings with chemical concepts that are in accordance with the college curriculum.

Results and Discussion

Ethnoscience of weaving in ethnoscience-based learning has been proven to improve conceptual understanding, scientific literacy, and environmental awareness [14-16]. Therefore, an in-depth exploration of local practices containing science is needed to be applied in contextual chemistry learning. Peringgesela Weaving, as one of the ethnosciences on Lombok Island, can be integrated with learning resources.

Peringgesela weaving is made with the main material being yarn. Currently, yarn is purchased from distributors, either yarn with synthetic dyes or undyed yarn. Undyed yarn is dyed using various natural materials available in the area, such as tarum leaves, to produce blue. The leaves are soaked until they ferment and produce indigo compounds through a reduction-oxidation process. Noni skin produces a reddish-brown color with the compound alizarin, while turmeric produces a yellow color because of its curcumin content, which is sensitive to changes in pH. *Indigofera tinctoria L* for black dye, *Curcuma domestica L* for yellow dye, *Vitex trifolia L* for light yellow dye, *Lannea nigritana L* for brown coloring, and *Jatropha gossypifolia L* for green dye [17]. However, several other materials that are new findings in the research are the existence of new materials in dyeing woven yarn, namely the use of mangosteen skin (*Garcinia mangosteen L*), young coconut skin (*Cocos nucifera*), jackfruit bark (*Artocarpus heterophyllus*) and many also use sappanwood skin (*Caesalpinia sappan L*) [18].

Natural colors used for yarn coloring are obtained from the process of boiling natural materials. To get the best dyes from natural materials, a long boiling will be carried out with a minimum duration of 4 hours using wood as fuel. One dye that comes from tarum leaves does not require a natural boiling process, only a pounding process. The process of burning firewood will certainly produce smoke that will disturb the surrounding community. The burning process is carried out in the yard or on the side of the road. If a more concentrated color is desired, the boiling process is also carried out longer.

Coloring materials such as jackfruit bark, mahogany, coconut skin or mangosteen can be used repeatedly by boiling. Tarum leaf paste can also be used repeatedly by storing the paste that has been made. The natural color of tarum leaf material is most special because it is made without a heating process, but by a crushing process, by pounding it into a paste. Paste from tarum leaf sediment produces an indigo blue color. To produce black, it requires a long coloring process because the thread must be dipped in an indigo solution and incubated in the soil until the desired color is obtained. Tarum twigs and leaves after the soaking process can be drained and then burned. Ash from

tarum twigs and leaves is used as natural fertilizer in the rice fields and becomes a mixture of dyes when dyeing thread.

Figure 1. Coloring process with natural ingredients

Figure 2. The process of boiling natural ingredients for natural dyes

After the coloring process using natural materials, the coloring will be fixed through a process of explaining the specified color. The colors produced from these materials depend on the use of alum fixation ($KAl(SO_4)_2$), camphor ($Ca(OH)_2$) or tunjung ($FeSO_4$). These three solutions are used because the metal complex group has the useful ability to improve the fastness of natural dyes. Natural dyes require a combination with metal complexes as found in the three fixative solutions [19]. In addition, the fixative solution used in the coloring process will make the resulting natural color less prone to fading and resistant to rubbing. Fixation wastewater discharged into the aquatic environment can cause pollution to the aquatic ecosystem because of the accumulation of toxic chemicals.

Peringgesela weavers have not used natural materials for the fixation process. There are 3 natural fixatives that can be used, namely coconut water, tamarind, alum and turnip plants (*Raphanus raphanistrum subsp. sativa*). Coconut water can be used as a fixative because it contains electrolytes, chloride, potassium, potassium, magnesium, sodium and riboflavin [20]. Tamarind can be used as a fixative because tamarind contains 8–14% tartaric acid, 30–40% sugar, and a small amount of citric acid, potassium bitartarate, polyphenol compounds, and flavonoids. Tamarind also contains ions K^+ from potassium bitartarate and ions H^+ from tartaric acid and citric acid, which can bind negatively charged particles, so that these particles will be destabilized to form larger particle sizes [21-22].

The results of the analysis of Environmental Chemistry material integrated with Peringgesela weaving ethnoscience are shown in Table 1.

Table 1. Environmental Chemical Content in the ethnoscience of Peringgesela Weaving

No	Environmental Chemistry Content in the Ethnoscience of Peringgesela Weaving
1.	Natural Resources as Natural Dyes
2.	Natural dyes are obtained from natural materials found in the environment, such as: *Mangifera Indica* for green, *Indigo* dyer blue and black, and *Swietenia Mahogany reddish* brown colour.
2.	Natural dyes are obtained by boiling natural ingredients.
3.	Boiling is done using firewood
4.	Natural ingredients for environmentally friendly color fixation
5.	To obtain a strong color, a fixation process is carried out using Alum, a chemical compound with the molecular formula $KAl(SO_4)_2$, camphor ($Ca(OH)_2$) and tunjung ($FeSO_4$)
6.	Eco-friendly natural material design for dyes and fixation process
7.	Natural ingredient composition that provides maximum color and is environmentally friendly

Table 1 shows that the ethnoscience of weaving peringgesela can be integrated into environmental chemistry learning about natural resources and environmental pollution. In addition, it can be integrated into waste management material. The liquid waste from the dyeing process is precipitated and used to water the plants. There is no use of synthetic chemicals, so the waste is relatively safe. The concepts of filtration, biodegradation, and green chemistry principles are very relevant in this context.

Cultural Values and Contextualization in weaving contain the values of mutual cooperation, nature conservation, and cultural preservation. This can be used to instil character values in Environmental Chemistry education and foster an attitude of caring for the environment. In the 21st Century, students are expected to have cultural literacy so that they not only get to know foreign cultures but also local cultures. In order for the existence of local culture to remain strong, integration in the learning process is needed. So that regional culture, local wisdom, and the surrounding environment can provide certain contributions to the learning experience [23-25].

Conclusion

Peringgesela traditional weaving has high ethnoscience value and can be used as a contextual learning resource for Environmental Chemistry. The process of dyeing, fixation, and waste management reflects the principles of chemistry that are relevant to the curriculum. With the integration of ethnoscience in Environmental Chemistry learning resources, it is hoped that students can reconstruct all forms of local wisdom that exist around them. In addition, this integration can improve scientific literacy, environmental awareness, and appreciation for local culture. Curriculum development needs to start exploring the potential of local culture as a learning medium based on local wisdom. Further research is recommended to compile teaching materials based on Peringgesela weaving and test their effectiveness in classroom learning.

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