
Reconstruction of Indigenous Knowledge into Scientific Knowledge in the Production Process of Batik Linggo

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Abstract

This study aims to reconstruct indigenous knowledge into scientific knowledge in the production process of Batik Linggo carried out in Singorojo District, Kendal Regency, Central Java, Indonesia. The description of this study is a number of scientific knowledge from the reconstruction of indigenous knowledge about the production of Batik Linggo. This study uses a qualitative descriptive method through interviews, direct observation, and literature study on the production of Batik Linggo. This research focuses on the Production Process description of Batik Linggo, especially the knowledge of Batik craftsmen related to raw materials and the production process of Batik Linggo. The data obtained were analyzed, verified, constructed into scientific knowledge, and interpreted to obtain meaningful information. Based on this research, it can be concluded that there is local wisdom found in the production of Batik Linggo that can be reconstructed into scientific knowledge.

Keywords: batik linggo, indigenous knowledge; scientific knowledge

Abstrak

Penelitian ini bertujuan untuk merekonstruksi pengetahuan tradisional menjadi pengetahuan ilmiah dalam proses produksi Batik Linggo yang dilakukan di Kecamatan Singorojo, Kabupaten Kendal, Jawa Tengah, Indonesia. Gambaran dari penelitian ini adalah sejumlah pengetahuan ilmiah dari hasil rekonstruksi pengetahuan tradisional tentang produksi Batik Linggo. Penelitian ini menggunakan metode deskriptif kualitatif melalui wawancara, observasi langsung dan studi literatur tentang produksi Batik Linggo. Fokus penelitian adalah proses produksi Batik Linggo khususnya pada pengetahuan pengrajin Batik terkait dengan bahan baku dan proses produksi Batik Linggo. Data yang diperoleh dianalisis, diverifikasi, dan dikonstruksi menjadi pengetahuan ilmiah dan ditafsirkan untuk mendapatkan informasi yang bermakna. Berdasarkan penelitian ini dapat disimpulkan bahwa terdapat kearifan lokal dari produksi Batik Linggo yang dapat direkonstruksi menjadi pengetahuan ilmiah.

Keywords: batik linggo; pengetahuan tradisional; pengetahuan ilmiah

Introduction

The very rapid development of science and technology has encouraged the development of science education which produces specific formal knowledge taught in schools. Whereas in traditional society, traditional knowledge (indigenous knowledge) is built in the form of symbolic messages, customs, and social culture. Indigenous knowledge is a holistic understanding of traditional communities in daily life according to their nature in interaction for centuries.

The original knowledge of the community contains various concepts, principles, or knowledge that have not been formalized (Emegwali & Shinzha, 2016). However, most of these traditional bits of knowledge have been abandoned or lost due to a lack of understanding of conservation and the importance of preserving this traditional knowledge (Adlina et al., 2013).

Reconstruction of indigenous knowledge to scientific knowledge will be able to develop creative thinking and character based on local wisdom, so that there will be a harmony generated between scientific knowledge and scientific attitudes based on local wisdom. All of which is one manifestation of the Unity of Sciences (Sudarmin et al., 2020). Reconstruction of indigenous knowledge is a concrete experience of an ethnic community in treating the universe towards the balance of its universe through cultural, anthropological, and social approaches (McKinley & Stewart, 2012). This local wisdom revitalization strategy can be done in three ways; (1) the recognition of the existence of local wisdom; (2) the use of local wisdom in scientific activities; and (3) the development and preservation of local wisdom in scientific activities (Fanani, 2015).

Knowledge of Batik Linggo production is one of the cultures owned by the people of Gonoharjo Village, Limbangan District, Kendal Regency. The production of Batik Linggo contains values that are full of wisdom and are embraced by local people, which have been forgotten by many. The

drawback found is that until now, there have not been many efforts to reveal the production potential of Batik Linggo in terms of quality and pedagogical knowledge until now.

Indigenous knowledge is usually only expressed verbally and symbolically according to experience. If traditional knowledge is reconstructed into scientific knowledge, it can be used as a source of additional knowledge (Sudarmin & Asyhar, 2012). Research on the reconstruction of indigenous knowledge into scientific knowledge is essential to be implemented to improve people's knowledge. Thus, that is trusted and can be empirically accounted for.

Method

This research was carried out in the Batik Linggo production house in Gono Barat, RT. 01 RW. 02 Gonoharjo Village, Limbangan District, Kendal Regency. The approach conducted in this research is qualitative research through ethnoscience. This ethnoscience approach will examine the knowledge system formed by culture in society (Battiste, 2005). This reconstruction focuses on the existing community culture. During data collection, researchers directly influenced the lives of many of the observed activities of Batik Linggo artisans. Primary data collection techniques are through observation, interviews, discussions, and direct observation in the field. Meanwhile, secondary data was obtained by studying cultural documents about the production of Batik Linggo.

The process of reconstructing indigenous knowledge into scientific knowledge in this research includes three stages: (1) Observation and exploration; This stage conducts observations and interviews with Batik Linggo Craftsmen to find out the process of making Linggo Batik. At this stage, it also explores information about the knowledge of Batik Linggo Craftsmen about terms and studies that occur in the process of making Batik Linggo in depth. (2) Data reduction and verification; this stage reduces traditional knowledge in the manufacture of Batik Linggo by reconstructing it into

scientific knowledge. This stage also verifies indigenous knowledge that can be reconstructed into scientific knowledge. (3) Validation and conceptualization; validate the references, relevant data, and experts at this stage—Discovery of scientific knowledge as concepts derived from the reconstruction of indigenous knowledge in making Batik Linggo.

Result and Discussion

The Batik Linggo production house is located in Gono Barat, RT. 01 RW. 02 Gonoharjo Village, Limbangan District, Kendal Regency. The business location of Batik Linggo is very strategic for tourism development because it is close to tourist attractions visited by domestic tourists and foreign tourists.

In general, Batik Linggo does use natural dyes to maintain its locality value. The natural dyes used include indigo leaf, tingi, mahogany, jalawe seed, jambal wood,

sappanwood, and tegeran. According to Zachrony, natural materials were chosen as batik dyes because production waste does not pollute the environment. In addition, there is a primary reason for the use of natural dyes, namely, the resulting color is more distinctive, nuanced, and calm.

Batik cloth made with natural dyes does not fade easily even though it has been washed repeatedly, even though it does not use lerak as a washing material. The color resistance of batik cloth is related to the process of dyeing the fabric repeatedly. Before the dyeing process, the fabric is soaked in boiling water first, often called scouring, to improve absorption, evenness, and color aging. In the final stage of dyeing batik cloth, a fixation process is carried out, namely the generation and color-locking process. These color-locking agents are in the form of alum, chalk, and tunjung and are used to ensure that the fabric has good fastness.

Figure 1

Mordanting Process



Figure 2

Soaking Indigofera Leaf Process



Figure 3

Washing Cloth Resulting from Nglorot (Removing) Process



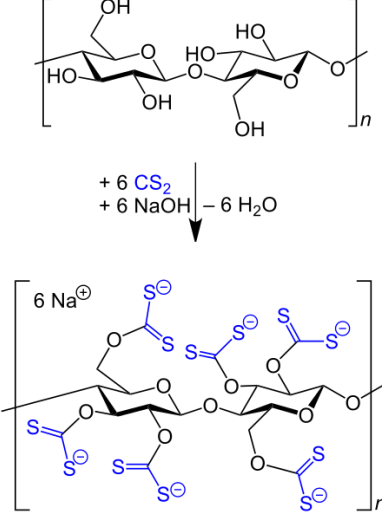
The process of reconstructing indigenous knowledge in the Batik Linggo production process focuses on knowledge about batik, preparation of batik making, batik coloring using natural materials,

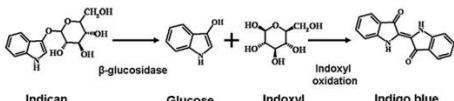
fixation, and the nglorot process. The details of the reconstruction of indigenous knowledge to scientific knowledge are presented in Table 1.

Table 1.

Indigenous knowledge and Scientific knowledge in the Production Process of Batik Linggo

Question of Scientific Concepts	Indigenous knowledge	Scientific knowledge
What types of fabric are used for the production of Batik Linggo?	Cotton, Silk, Calico, Rayon	<p>Cotton is a cellulose fiber. Fiber is a hydroxyl group so that dyes can form covalent bonds. The cationic properties and affinity (attraction) of the dye are not good for cotton fabrics and only deposit on the surface due to the presence of ionic attractive forces.</p> <p>Silk is a natural fiber and contains protein. Silk fabric has a smooth texture, soft but not slippery. The sparkle of silk fabric is the main attraction. This luster comes from the triangular prism-like structure of the fibers, which makes the silk fabric able to bend light from different angles (Prabhu & Bhute, 2012).</p> <p>The calico fabric (<i>mori</i>) is a fabric that has never been bleached. The calico fabric contains 94% cellulose, which has hygroscopic fibers (able to absorb water molecules well) (Fakriyah et al., 2015). Since the calico fabric has a strong affinity for humidity, it is usually stored in closed containers.</p> <p>The process of making viscose rayon fiber according to the following reaction:</p>

Question of Scientific Concepts	Indigenous knowledge	Scientific knowledge
		 <p>The main difference between cellulose fiber and viscose rayon fiber is the lower degree of polymerization due to polymer chain degradation during manufacture. The basic material of viscose rayon fiber is wood, purified then with Sodium Hydroxide (NaOH) converted into Sodium Cellulose Xanthate. Then it is dissolved in a dilute NaOH solution, then curdled, and finally spun using an acid solution (Mulyawan et al., 2015) Science concepts: Characteristics of Matter</p>
<p>What was done before the fabric was used for batik?</p>	<p>The fabric is soaked in water to which soda ash is added to open the pores of the fabric</p>	<p>The mordanting process must be carried out accurately to produce a stable color. The mordanting process also increases the fabric's absorption against natural dyes and produces a clearer evenness and sharpness of color. Metal salts will chemically bind the color carriers present in natural dyes, are more soluble, and easily react with fabrics (Maulidya, 2017). Science concepts: Characteristics of Matter</p>
<p>How many types of wax are used for the batik process?</p>	<p>There are three types, namely Klowong wax (to glue the first motif or emphasize the motif of the fabric/<i>nglowong</i>), Tembakan wax (to fill a wide area/block a pattern so that the fabric with a motif image can be hindered) and Biron wax (to cover specific motifs that are maintained in the fabric after dyeing process or <i>nyolet</i>)</p>	<p>The types of batik wax commonly used are hand-drawn batik wax, stamped batik wax, and wax used to block large areas (<i>nombok</i>). Batik wax is a mixture of paraffin wax, microcrystalline microcrystalline, beeswax, gondorukem, and animal fat (Atika & Agus, 2013). Pure white paraffin is transparent, odorless, and has the chemical formula $C_{20}H_{42}$ with a melting point of about 56-62°C (Asinger, 1968). Beeswax is naturally derived from beeswax, is slightly dark in color, smells good, and has a melting point of about 54°C. Beeswax is added to the wax mixture to smooth the paraffin so that it can stick to the fabric and not crack easily (Junus et al., 2017). Microcrystalline is a synthetic form of beeswax. Microcrystalline functions the same as beeswax; Microcrystallin has a melting point of around 71-</p>

Question of Scientific Concepts	Indigenous knowledge	Scientific knowledge
		<p>77°C (Belali et al., 2019). Gondorukem (<i>Resina colophium</i>) is a processed product of the steam distillation of pine stem sap (oleoresin) in addition to turpentine oil. Gondorukem has a brownish yellow solid form, while turpentine oil is a clear white liquid (Khadafi et al., 2014). While animal fat is obtained from beef with a low melting point, so it melts easily. Animal fat is used as a mixture in batik wax so that the batik wax is easily re-released (<i>nglorod</i>). This causes faster production times, and the level of sharpness of colors and motifs can be maintained (Haerudin & Atika, 2018).</p> <p>Science concepts: mixture, compounds, chemical, and physical characteristics</p>
<p>Canting batik made of what materials?</p>	<p>Which is often made of copper</p>	<p>Copper is often found in sulfide ores such as chalcopyrite (CuFeS₂) or chalcocite (Cu₂S), with a concentration of 0.6% (Greenwood, 1997). The copper concentration can be increased up to 10-15% through the front flotation process or bioleaching (Khoshkhoo, 2016).</p> <p>The process of heating copper material using silica in flash smelting can release iron content and convert iron sulfide into its oxide.</p> $2 \text{Cu}_2\text{S} + 3 \text{O}_2 \rightarrow 2 \text{Cu}_2\text{O} + 2 \text{SO}_2$ <p>Copper oxide is then heated:</p> $2 \text{Cu}_2\text{O} \rightarrow 4 \text{Cu} + \text{O}_2$ <p>This process converts only half of the sulfide to oxide and then removes all of the sulfur to oxide. This process will convert the copper oxide into metallic copper. Natural gas is then flowed to remove oxygen (electrorefining process) to convert the material into pure copper then (Samans, 1949):</p> $\text{Cu}^{2+} + 2 \text{e}^- \rightarrow \text{Cu}$ <p>Science concepts: energy, energy change, redox</p>
<p>What materials are used as dyes, and how do you make them?</p>	<p>The materials used are jalawe seed, tingi wood, and indigo leaves. For Jalawe seed and tingi wood, boiled in a ratio of 1 kg of ingredients: 7-10 liters of water for 30-60 minutes. Meanwhile, indigo leaves are harvested in the morning or evening. Made by soaking indigo leaves in a ratio of 1 kg of ingredients: 60 liters of water for 24 hours with added sugar (palm sugar, cane sugar) until the color turns blue. After soaking, the results of the marinade are stirred while being poured so that they are exposed to the air</p>	<p>Indigofera is a carbonyl compound commonly used as a dye. Indigofera plants contain indikan, a derivative of glucoside compounds (Suharlina & Sanusi, 2020). Immersion of Indigofera plants will occur through a hydrolysis process with the addition of acid compounds. Acid compounds function to hydrolyze glycoside groups into indoxyl and glucose (Handayani & Mualimin, 2013).</p> <p>The oxidation reaction of indoxyl to indigo produces a blue color like the following reaction:</p>  <p>This oxidation reaction is carried out by means of the aeration process. The longer the aeration process is carried out, the higher the level of</p>

Question of Scientific Concepts	Indigenous knowledge	Scientific knowledge
	(aerated)	<p>indigo produced because the more indoxyl contained in the filtrate is oxidized (Handayani & Mualimin, 2013).</p> <p>Soga tingi and jalawe seed produce tannins, which are usually used as leather tanning agents, and dyes for paints (Handayani & Maulana, 2013). The extraction of tannins is carried out by an extraction process (Pratini & Florentina, 2017).</p> <p>Science concepts: Hydrolysis, Extraction</p>
How to color using natural materials?	Immersion in a dye solution on the part coated with batik wax is not colored. Aerated fabric. Dyeing is repeated according to the desired color	<p>Batik wax contains oil and is a non-polar covalent bond, while the dye solution contains water which is a polar covalent bond. Thus the oil and water will not dissolve in each other. For example, coloring with natural ingredients from the bark of jalawe seed, tingi, and Indigofera leaves. Fabrics that have been dyed with natural dyes will form hydrogen bonds between the phenolic hydroxyl groups of the tannin compounds in the dyes and the hydroxyl groups of cellulose and protein fibers (Mongkhorrattanasit et al., 2016).</p> <div data-bbox="837 1064 1316 1265" style="text-align: center;"> </div> <p>Science concepts: chemical bond</p>
What materials are used for fixation?	Alum water, chalk water, and tunjung water	<p>Fixation can be done with several materials such as alum $[KAl(SO_4)_2]$, chalk $[Ca(OH)_2]$, tunjung $(FeSO_4)$. The alum binding agent reacts between Al^{3+} ions and the dye, the chalk binder reacts between the Ca^{2+} ions and the dye, and the tunjung binding agent reacts between the Fe^{2+} ions and the dye. These metal salts can strengthen bonds and change the direction of natural dyes based on the type of metal salt that binds them (Pujilestari, 2014). Alum and chalk give the color direction according to the base color, while tunjung gives a darker color.</p> <p>Science concepts: chemical bond</p>
What is the process of <i>nglorot</i> batik wax?	Dip in hot water with a soda ash mixture. After the wax is removed, the wax is removed and immediately washed with detergent	<p>The process of <i>nglorot</i> on batik fabric aims to release the wax attached to the fabric so that the colors and motifs of the fabric can be seen. This process is done by dipping a piece of fabric in boiling water to which soda ash has been added. Soda ash/ Sodium carbonate (Na_2CO_3) is formed from a solution of table salt ($NaCl$) in concentrated ammonia (NH_4OH) which is flowed with carbon dioxide gas (CO_2). The precipitated</p>

Question of Scientific Concepts	Indigenous knowledge	Scientific knowledge
		<p>sodium bicarbonate (NaHCO_3) is separated, dried, and heated to form dry sodium carbonate. The properties and characteristics of soda ash are white; the dry one does not contain crystallized water (Na_2CO_3). In contrast, the crystal has 1 mole of crystal water ($\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$), highly absorbs water, the solution in water is alkaline (alkaline) and if touched by hand, Feels cool. Soda ash is a weak alkaline solution. Soda ash is used in the chlorodan process to hydrolyze the fat (R-COOH) in the wax into a water-soluble soap. The addition of detergent to the chlorodan process serves to prevent dirt from settling again (Topaloğlu & Kıyıcı, 2015). Science concept: Energy, Hydrolysis</p>

The results of the analysis of local wisdom found in the production of Batik Linggo found that the local wisdom of the Lendoh community is still being preserved, and it is believed that its existence is appropriate if it is to be integrated into science learning. This statement indicates that the community is still preserving indigenous knowledge, so it will be a source of learning if it is found and has something to do with science.

People still preserve culture because they have seen and experienced the truth according to life experience (scientific experiments) for years from one generation to the next through trial and error processes. This indigenous knowledge is transformed through oral traditions from their parents to the next generation and real experiences in interacting in their environment (Sumarni et al., 2016). In the course of time, new cultures can come according to the development of technology and science, but the way of thinking (beliefs) inherited from previous generations is maintained.

Conclusion

Based on this study, it was found that there is scientific knowledge reconstructed from indigenous knowledge in the process of making Batik Linggo. The scientific concepts generated from the reconstruction can be integrated into learning activities and extra

activities. Through things like this, it is hoped that knowledge will bring knowledge closer to life in society and increase competence and, of course, strengthen the nation's culture. Based on the research that has been carried out, there are some things that are still not well identified. Therefore, some recommendations based on the results of this research are needed to characterize the substances involved in the production process of Batik Linggo both qualitatively and quantitatively and socialize them with the community through socio-ecopreneurship-based community empowerment service programs.

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