Ethnoscience-Based Science Learning in Sasak Ethnic Culture: Literature Review

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Abstract: This study aims to elaborate on science learning based on indigenous science, the culture of the Sasak ethnic of Lombok. This study is library research with data sources from previous research articles that have topics related to science learning, science concepts, ethnoscience, and songket cloth, poteng jaje tujak, and bale adat. The procedure in literature study research is carried out in stages, namely collecting library data, reading, taking notes, studying, collecting concepts or manuscripts, then carrying out elaboration and explanation of the collected data/text. The study results show that (1) the nature of learning science can be classified into three dimensions, namely science as a product, science as a process, and science as an attitude; (2) indigenous science in songket wayang motifs, subulmule motifs keker motifs four star, and danginglumbung which have relevance to the basic science competence of “analyzing the reproductive system in plants and animals and the application of technology to the reproductive system of plants and animal”; (3) indigenous science in the materials for making bale adat has relevance to the basic competence of natural science on “analyzing the interrelationships of plant tissue structures and their functions, as well as technology inspired by plant structures”; (4) indigenous science in the process of making poteng jaje tujak has relevance to the basic competence of natural science regarding “applying the concept of biotechnology and its role in human life”.

Keywords: Ethnoscience; Sasak ethnic culture; Science learning

Introduction

Education is a planned and structured activity (Purwanto, 2011; Darmiwati, 2006) to develop the potential of each generation in order to be able to build civilization in the future (Hadi & Ahied, 2017; Hadi et al., 2019). Civilization development can be carried out by strengthening the understanding of the nation's children towards the heritage of their predecessors in the surrounding environment such as culture and customs (Sarini & Selamet, 2019). Hadi & Ahied (2017) emphasized that education is an effective, structured effort to introduce culture through learning activities. According to Suastra (2011) that education has a formal role in cultivating and acculturating student behavior in preserving culture. Education and socio-culture have a positive correspondence that must be realized in learning for the nation's generation (Trianto, 2014). Social culture can make a certain contribution to student learning experiences both in cognitive, affective, and psychomotor aspects (Irawan & Muhartati, 2019). Hadi et al. (2019) state that socio-cultural diversity in Indonesia can be optimized to support multidimensional science learning in schools. Science learning is the initial foundation in creating students who have dimensional competencies such as knowledge, skills and scientific attitudes (Mardiana, 2018; Ali, 2018).

Natural Science (IPA) is a science that studies natural phenomena in people's lives (Khoiri & Sunarno, 2018). The concept of science has a relationship with the social life of society (Setyowati et al., 2013), so that through learning science, direct experience can be obtained in exploring and applying concepts related to everyday life (Puspasari et al., 2019). Seroto (2012) emphasized that the concept of natural science originates from and refers to daily activities, thus enabling students to think scientifically about the
surrounding environment (Listyawati, 2012). Science learning can be developed by relying on the uniqueness and potential of an area such as local culture and traditions (Kartono et al., 2010). Local wisdom is a characteristic (uniqueness) of an area that develops in a local environment from generation to generation (Toharudin, et al., 2017). Mardianti, Kasmantoni & Walid (2020) explain that local wisdom is original knowledge (indigenous science) that comes from the noble values of cultural traditions (Rahayu, et. al., 2021; Ardianti, et. al., 2019; Sudarmin, et. al., 2019; Setiawan, et. al., 2017). Science learning is important to contain local wisdom-based concepts in order to prevent the loss of cultural and traditional characteristics in an area (Kasa, 2011).

Science learning is a process of discovery and formation of scientific attitudes (Mardiana, 2018). According to Suastra (2009) that learning science is an ideal way to acquire competency skills, maintain attitudes, and develop mastery of concepts related to everyday life. Science education is expected to be a vehicle for students to learn about the natural surroundings and prospects for further development in everyday life (Ali, 2018). Rizkianawati et al. (2014) explained that the science learning process prioritizes giving direct experience to develop competencies in order to explore and understand the natural surroundings scientifically. Thus, science learning is directed to inquiry and project-based (Zulfa, et al., 2022; Samsudin, et al., 2020; Afriana, Permanasari & Fitriani 2016) to build students' direct experience about nature (Kubicek, 2005), creativity and thinking skills (Ummah et al., 2019; Anazifa & Djukri, 2017). Indriani (2013) explains that science learning can also be developed with scientific inquiry to foster creative thinking and literacy skills (Atmojo et al., 2021; Suryadari, et al., 2018) as important aspects of life skills (Rizkianawati et al., 2014).

Science learning is expected to be able to explore the dimensions of science as a product, science as a process, and science as an attitude (Ali, 2018), as well as dimensions of procedure and science as technology as a result of the development of these three components (Chain & Evan, 1990). To realize the multidimensional science learning, active involvement of students is required to interact with concrete objects in everyday life (Ali, 2018; Mardiana, 2018; Rizkianawati et al., 2014; Koes, 2003). This is emphasized by Khoiri & Sunarno (2018) that science learning must be contextual so that it can present natural phenomena in people's lives in every science concept learning activity (Khoiri & Sunarno, 2018; Setyowati et al., 2013). Science learning can facilitate students to gain direct experience in exploring and applying science concepts related to everyday life (Puspasari et al., 2019). This learning activity certainly allows students to think scientifically about a natural condition and the surrounding environment (Listyawati, 2012; Seroto, 2012). Thus, the development of science learning should rely on the uniqueness and potential of the environment around students in each region such as local culture and traditions (Kartono et. al., 2010). Local culture and traditions that are characteristic (uniqueness) of an area (Toharudin, et al., 2017) contain indigenous science originating from the noble values of tradition (Rahayu, et. al., 2021; Ardianti, et. al., 2019; Sudarmin, et. al., 2019; Setiawan, et. al., 2017) can be scientifically based on the concept of natural science (Khoiri & Sunarno, 2018). Learning the concept of science based on indigenous science is known as ethnoscience (Wati et al., 2020; Sudarmin et al., 2018). Integrating ethnoscience in science learning is in order to present contextual learning, accommodate regional uniqueness, explore natural science dimensions comprehensively, and prevent the loss of cultural and traditional uniqueness in an area (Kasa, 2011).

The diversity and uniqueness of the traditions and culture of an area (Sarini & Selamet, 2019), contains indigenous sciences (Battiste, 2005). According to Arlinovita, Setiawan & Sudibyo (2015), daily social activities cannot be separated from the culture that developed and was passed down by previous generations (Rahayu, et. al., 2021; Ardianti, et. al., 2019; Sudarmin, et. al., 2019; Setiawan, et. al., 2017). Indigenous science can be elaborated scientifically (Khoiri & Sunarno, 2018) in science learning (Hadi, et al., 2019). Toharudin, et al. values indigenous science in learning natural sciences (Parmin, et al., 2017; Wati et al., 2020). Thus, science learning is based on ethnoscience as a system of knowledge and cognition typical of a given culture (Hume, 1999; Sudarmin et al., 2018). Ethnoscience-based science learning can build an effective learning environment (Wahyu, 2017) by associating cultural and traditional values (Puspasari et al., 2019), so that it is useful for students' lives (Mardianti et al., 2020; Sudarmin, et al., 2019). Ethnoscience-based science learning is based on constructivism principles (& Pujani, 2020) and prioritizes meaningful learning (Akmal et al, 2020; Sudarmin, et al. (2019), so as to facilitate students to learn while doing (learning by doing) (Atmojo et al., 2021; Alvonco 2014; Sudarmin, et al., 2019).

Lombok's Sasak societies have various cultures and traditions inherited from their predecessor generations (Arlinovita, Setiawan & Sudibyo, 2015). Some of the distinctive traditions of the Sasak ethnics which contain indigenous science cloth motifs Songket have a philosophical meaning in the life of the Sasak (Sumadewa & Hasbullah, 2021), because Songket reconstructed from images of humans, stars, flowers, animals, nature, and customary property (Misnawati, 2016). According to Muladi et al. (2022) that the motif of the Songket contains indigenous science that has
relevance become a source of learning science in schools. (2) Typical food of the Sasak societies such as poteng reket contains indigenous science in the manufacturing process that is relevant to the concept of biotechnology (Hikmawati et al., 2020). According to Anwar, Supardi & Sugiharto (2012), the concept of biotechnology has a very real contribution in various local community products through the use of microorganisms to speed up the productivity process (Anwar et al., 2012). (3) The making bale adat (traditional house) currently still maintains indigenous science which has been passed down from generation to generation, using natural materials that are often found around the community, such as wood, bamboo, reed leaves, and tree sap which function to clean the house and prevent from insect attacks (Wir'aeni, 2017). Spreading buffalo dung on the floor of the house functions as a remover of soil moisture and also functions as a mosquito repellent, so residents have a distinctive habit of mopping the floor using buffalo dung every two weeks (Widianti, 2017; Wir'aeni, 2017).

Indigenous science contained in the culture and traditions of the Sasak societies can be integrated into science learning (Sudarmin et al., 2018). This is supported by the opinion of Chiapetta & Koballa (2010) that one of the important dimensions in studying natural science is to construct the relationship between science and technology and society. Ethnoscience-based science learning is important for students to build an attitude of loving culture and local wisdom through an introduction to the cultural potential of an area (Sudarmin, et al., 2019; Parris & Linder-VanBerschot, 2010). Ethnoscience as knowledge of local wisdom is effective for developing students' tolerance for the diversity of cultures and local traditions in each region (Hikmawati et al., 2020; Akmal et al., 2020; Wahyu, 2017). The technoscientific approach can fortify students from the acculturation of foreign cultures transformed by today's very massive electronic media (Sudarmin, et al., 2019; Mardianti et al., 2020). Thus, Ethnoscience-based learning can comprehensively construct students' knowledge about the surrounding environment and avoid alienation from their environment (Parmin, et al., 2017; Wahyu, 2017; Listyawati, 2012). According to Krajcik et al. (1999) that ethnoscience learning is more oriented towards an integrated (interdisciplinary) understanding rather than just an in-depth understanding (Chiapetta & Koballa, 2010).

Method

This study is a literature study (library) (Andi, 2012; Sugiyono, 2017), to elaborate the concept of science learning based on indigenous science in the culture of the Lombok Sasak ethnicities (Khoiri & Sunarno, 2018). The data sources for this research were previous research articles published in journals with topics related to science learning, science concepts, ethnoscience, songket cloth, poteng jaje tujak, and bale adat. This is in accordance with the opinion of Sukmadinata (2007) that literature study research data is data that has a certain quality of meaning that is expected to find meaning in reality, events, social activities, perceptions and thoughts that are put forward as the object of analysis or the main research discourse.

The procedure in literature study research is carried out in stages, namely collecting library data, reading, taking notes, studying, collecting concepts or texts, then elaborating and explaining the data/text collected about ethnoscience-based science learning (Rahyu, 2018). This is in accordance with the opinion of Zed (2018) that library research is not just a matter of reading and recording literature or books, but a series of activities related to methods of collecting library data, reading and recording and processing research materials.

Result and Discussion

Description of The Nature of Science Learning

Natural Science (IPA) is a science that studies natural phenomena in people's lives (Khoiri & Sunarno, 2018). The concept of science has a relationship with the social life of society (Setyowati et al., 2013), so that through learning science, direct experience can be obtained in exploring and applying concepts related to everyday life (Puspasari et al., 2019). Seroto (2012) emphasized that the concept of natural science originates from and refers to daily activities, thus enabling students to think scientifically about the surrounding environment (Listyawati, 2012). Science learning can be developed by relying on the uniqueness and potential of an area such as local culture and traditions (Kartono et al., 2010). Local wisdom is a characteristic (uniqueness) of an area that develops in a local environment for generations between generations (Toharudin, et al., 2017). Mardianti et al. (2020) explain that local wisdom is original knowledge (indigenous science) that comes from the noble values of cultural traditions (Rahyu, et. al., 2021; Ardianti, et. al., 2019; Sudarmin, et. al., 2019; Setiawan, et. al., 2017). Science learning is important to contain local wisdom-based concepts in order to prevent the loss of cultural and traditional characteristics in an area (Kasa, 2011).

Science learning is a process of discovery and formation of scientific attitudes about (Mardiana, 2018). According to Suastra (2009) that learning science is an ideal way to acquire competency skills, maintain attitudes, and develop mastery of concepts related to everyday life. Science education is expected to be a vehicle for students to learn about the natural surroundings and prospects for further development in everyday life (Ali, 2018). Rizkianawati et al. (2014)
explained that the science learning process prioritizes giving direct experience to develop competencies in order to explore and understand the natural surroundings scientifically. Thus, science learning is directed to inquiry and project-based (Zulfa, et al., 2022; Samsudin, et al., 2020; Afriana, et al., 2016) to build students' direct experience about nature (Kubicek, 2005), creativity and thinking skills (Ummah, et al., 2019; Anazifa & Djukri, 2017). Indriani (2013) explains that science learning can also be developed with scientific inquiry to foster creative thinking and literacy skills (Suryadari, et al., 2018) as important aspects of life skills (Rizkianawati, et al., 2014).

Science learning does not only develop mastery of knowledge of facts and concepts alone, but is also a process of finding out inquiry, discovery and creative skills (Agusti, 2017). The nature of science learning contains four main dimensions, namely scientific processes, scientific knowledge, scientific attitudes, and technology (Puskur, 2006). Muliadi (2019) explains that scientific processes mean scientific methods or activities to describe natural phenomena so that scientific products are obtained in the form of facts, principles, laws, theories. On Science a Process Approach states that a learning approach that is oriented towards scientific process skills involves intellectual, manual, and social skills (Carin, 1997). Scientific is an attitude, belief, values, ideas and objectivity that will emerge after carrying out a scientific process known as a scientific attitude (Sulthon, 2016), such as being honest, thorough, objective, patient, not giving up easily (resilient), respecting people, others, and others (Muliadi, 2019). Technology in science is interpreted as the application of science which acts as a tool to solve problems in everyday life (Sudarisman, 2015). Another opinion was conveyed by Ali (2018) that the nature of learning science can be classified into three dimensions, namely science as a product, process, and attitude. While science is also referred to as procedure and technology which is the result of the development of these three components (Chain & Evan, 1990).

Science learning is expected to be able to develop multidimensional science dimensions (Ali, 2018), so that active involvement of students is needed to interact with concrete objects in everyday life (Ali, 2018; Mardiana, 2018; Rizkianawati, et al., 2014; Koes, 2003). This is emphasized by Khoiri & Sunarno (2018) that science learning must be contextual so that it can present natural phenomena in people's lives in every science concept learning activity (Khoiri & Sunarno, 2018; Setyowati, et al., 2013). Science learning can facilitate students to gain direct experience in exploring and applying science concepts related to everyday life (Puspasari, et al., 2019).

This learning activity certainly allows students to think scientifically about a natural condition and the surrounding environment (Listyawati, 2012; Seroto, 2012). Thus, the development of science learning should rely on the uniqueness and potential of the environment around students in each region such as local culture and traditions (Kartono, et al., 2010). Local culture and traditions that are characteristic (uniqueness) of an area (Toharudin, et al., 2017) contain indigenous science originating from the noble values of tradition (Rahayu, et. al., 2021; Ardianti, et. al., 2019; Sudarmin, et. al., 2019; Setiawan, et. al., 2017) can be scientifically based on the concept of natural science (Khoiri & Sunarno, 2018). Learning the concept of science based on indigenous science is known as ethnoscience (Wati, et al., 2020; Sudarmin, et al., 2018). Thus, the integration of ethnoscience in science learning is expected to present contextual learning, accommodate regional uniqueness, comprehensively explore natural science dimensions, and prevent the loss of cultural and traditional uniqueness in an area (Kasa, 2011).

Ethnoscience-based science learning can facilitate students to learn to find out about nature systematically, so learning science is not only about conceptual knowledge, but there is a process of discovery and the formation of scientific attitudes (Mardiana, 2018). According to Panggabean et al. (2021) that science learning can equip students with knowledge, ideas, and concepts about life around them through scientific processes (Lestari, 2019). The scientific process dimension has a very important role in facilitating students to develop knowledge, thinking habits, attitudes, and life skills (Yunita, 2018). Suastra (2009) emphasized that learning science is an ideal way to acquire competency skills, maintain attitudes, and develop mastery of concepts related to everyday life. The science learning process must prioritize the provision of direct experience to develop students’ competencies in exploring and understanding the natural surroundings scientifically (Rizkianawati, et al., 2014). Thus, science learning is directed to inquiry and project-based (Zulfa, et al., 2022; Samsudin, et al., 2020; Afriana, et al., 2016) to build students' direct experience about nature (Kubicek, 2005), creativity and thinking skills (Ummah, In'am & Azmi, 2019; Anazifa & Djukri, 2017). Indriani (2013) explains that science learning can also be developed with scientific inquiry to foster creative thinking and literacy skills (Suryadari, et al., 2018) as important aspects of life skills (Rizkianawati, et al., 2014).

According to Koes (2003), realizing multidimensional science learning, students must be actively involved in interacting with concrete objects in everyday life. Indigenous science in the culture and traditions of the Sasak societies is an object of contextual study that is relevant for exploring students' multidimensional competencies. This is in accordance with the opinion of Kartono et al. (2010) that the concept of learning science can be explored from indigenous
science in everyday life to strengthen mastery of concepts, attitudes and skills. Ethnoscience-based science learning can present a meaningful learning and constructivist learning process (Akmal et al, 2020). In addition, according to Alvonco (2014) that ethnoscience-based science learning can facilitate students to learn science by doing, making it possible to connect the science concepts learned with indigenous science contained in Sasak Traditional House (Puspasari et al., 2019). Muliadi et al., (2022) explained that science learning must contain 5 elements, namely: 1) active learning, which involves active students in a series of scientific processes through science process skills; 2) inquiry activity approach, namely learning in science which encourages students' curiosity and seeks answers through discovery 3) scientific literacy, namely learning that can accommodate students regarding content knowledge of science concepts, competencies/scientific skills, and scientific attitudes; 4) constructivism, namely learning that allows students to construct knowledge through their experiences independently; 5) science, technology, and society, namely using science to solve everyday problems that exist in society.

Description of Ethnoscience Study in Sasak Ethnic Culture

Ethnoscience is knowledge that comes from norms, customs, culture, traditions, and beliefs that influence people's understanding and interpretation (Sudarmin, 2014). Ethnoscience is said to be an activity of transforming indigenous science from people's knowledge of typical facts that have been passed down from generation to generation (Putra, 2021). Ethnoscience is an activity to transform indigenous science into scientific knowledge (Wati et al., 2020). Sudarmin et al. (2018) explained that culture is the result of human taste creation and initiative which then develops into indigenous science which is transformed into scientific science. Indigenous science is described from the culture of society which includes everything that a person must know and believe in doing activities according to the roles and ways that are acceptable to its members in a community (Putra, 2021). Regional culture, local wisdom, traditions, and the surrounding environment will make a certain contribution in constructing students' cognition about indigenous science (Hikmawati et al., 2020) Ethnoscience can increase students' knowledge (cognition) about the surrounding environment, especially those related to traditions, culture as ancestral heritage (Hadi & Ahied, 2017). Furthermore Hikmawati et al. (2020) explained that the indigenous science contained in each culture is different depending on the peculiarities of each region in Indonesia.

The Lombok Sasak societies have various cultures and traditions inherited from their predecessor generations (Arlinovita et al., 2015). Some of the typical cultures and traditions of the Sasak ethnics which contain indigenous knowledge motifs Songket which are reconstructed from images of humans, stars, flowers, animals, nature, and customary properties (Misnawati, 2016); (2) The special food of poteng jaje tujak which is made using a fermentation mechanism (Hikmawati et al., 2020); (3) Making Bale adat (traditional house) that still maintains ancestral teachings in using natural materials that are often found around the community, such as galih wood, bamboo, reed leaves, tree sap, and rubbing buffalo dung on the floor of the house functions as a remover of soil moisture (Widianti, 2017; Wir'aeni, 2017).

1. Indigenous science in songket motifs songket

Typical cloth of the Sasak ethnics of Lombok has varied motifs with strong philosophical meanings in the life of the Sasak societies (Sumadewa & Hasbullah, 2021). Motif songket is a symbol resulting from the reconstruction of social values in the Sasak ethnics which was deduced from generation to generation (Jayadi, 2016). Knowledge Indigenous science contained in songket cloth constructed through symbols in wayang, subahmalle, keker atau merak, bintang empat, dan alang (Nurmeisarah et al., 2015). The results of Misnawati's research (2016) explain indigenous science in the songket cloth, namely (1) the wayang reconstructed from the image of a tanjung flower, with the meaning that humans must live together and respect each other; (2) the subahmalle reconstructed from images of tanjung flowers and kenanga flowers, with the meaning of God Almighty because it is based on the word Subhanallah; (3) motifs keker atau merak, with the meaning of a symbol of eternal holy love; (4) motif bintang empat of the four stars (morning star) and the fried flower, with the meaning of the cardinal directions to determine the calendar; (5) motif alang in the form of alang or barn, tanjung flower, and kenanga flower, with the meaning of a symbol of welfare and prosperity.

Motifs Songket are reconstructed from images of humans, stars, flowers, animals, nature, and customary properties (Misnawati, 2016), allowing it to be used as a source of learning natural science/science concepts in schools. This is supported by the opinion of Hadi & Ahied (2017) that cultural diversity and local wisdom are important to be utilized as a source of ethnoscience learning. Nadhifatuzzahro & Suliyanah (2019) emphasized that integrating songket in ethnographic learning is one of the innovations for creating an effective learning environment. This is in accordance with the opinion of Sapitri et al. (2020) that ethnoscience learning needs to be adapted to the culture and environment around students. Ethnoscience learning by utilizing songket can facilitate students to identify, elaborate, communicate and conclude about scientific science from indigenous science contained in songket.
Thus, educators must have the competence, creativity, and innovation to integrate local cultural values in science and non-science learning processes (Wati et al., 2020).

2. Indigenous science in making poteng jaje tujak

Poteng jaje tujak is a typical food of the Sasak ethnics of Lombok which is made from sticky rice. Poteng jaje tujak is a traditional snack of the Sasak which is usually served only during certain celebrations such as traditional celebrations or Eid al-Fitr or Eid al-Adha. Poteng Jaje Tujak consists of two types of typical snacks, namely Poteng Reket and Jaje Tujak (Hikmawati et al., 2020). Poteng Jaje Tujak is a type of sticky tape food in other regions of Indonesia (Nurhidayah et al., 2017). Poteng Jaje Tujak is produced from the fermentation process of white sticky rice or black sticky rice and even a mixture thereof (Hidayat et al., 2006). Devindo et al. (2021) explained that food products such as Poteng Reket are produced from a fermentation process through the breakdown of carbohydrates in sticky rice into a simple form, namely sugar, with the help of a microorganism called yeast or yeast. Jaje Tujak pots contain probiotics which can provide health benefits (Salminen et al., 1998). According to Dede et al. (2018), food nowadays, especially in developed countries, not only has filling properties but also has to be healthy, such as consuming food ingredients that contain probiotics.

Ingredients for making Poteng Reket are sticky rice, tape, and clean water (Nurhidayah et al., 2017). The main process in making Poteng Reket is fermentation using a starter (bio activator) in the form of microbes found in tape yeast derived from molds, yeasts and bacteria such as Endomycopsis sp, Saccharomyces sp, Hansenula sp, and Candida sp (Badrisiyani, 2012; Waluyo, 2011). Lombok’s societies, the production of Poteng Reket is usually added with katuk leaf juice which is used as a natural dye for Poteng Reket made from white sticky rice so that it looks attractive for consumption and produces a sweet taste and can be stored even longer (Nurhidayah et al., 2017). Katuk leaves contain tannins, flavonoids, steroids, saponins and tripertenoids which act as antibacterial in the presence of these bacterial substances that can inhibit fungal-plaguing bacteria that play a role in the fermenting process of glutinous rice (Malaningtyas, 2010).

3. Indigenous science in materials for making bale adat

Lombok has several tourist destinations which are famous for preserving traditional houses typical of the Sasak ethnics, for example Sade Village, Central Lombok (Muliadi et al., 2022). The typical house of the Lombok Sasak societies is known as the Bale adat (traditional house) and contains indigenous science such as the use of materials, manufacturing processes, and architecture (Hikmawati et al., 2020). Traditional house scattered in several locations, such as Bale (house), Segenter traditional house in Bayan District, North Lombok, Sade traditional house in Pujut District, Central Lombok, and Limbungan traditional house in the village of Perigi, Suela District, East Lombok (Wir’aen, 2017). Widianti (2017) explains that the traditional house type of the Sasak ethnics consists of several types, namely bale belingah, bonter, bale tani, bale jajar, berugag (sekepat-sekenem). Puspita (2017) and Widianti (2017) describe the seven types of Sasak traditional house as presented in the following Table 1.

<table>
<thead>
<tr>
<th>Bale Adat Type</th>
<th>Indigenous Science Society</th>
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<tbody>
<tr>
<td>Bale Beleq Bencingah</td>
<td>Bale Beleq is one of the important facilities in a kingdom that is designated as a place for major royal activities so it is often also called Bencingah. The royal ceremonies that are usually performed at Bale Beleq include the inauguration of royal officials, the coronation of the royal Crown Prince, the inauguration of the royal Kaisi Pengulu (Priests), and the storage of royal heirlooms.</td>
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<td>Bale Bonter</td>
<td>Bale Bonter is generally owned by Perkanggo/Village Officials, hamlets/village. Bale Bonter is usually built in the middle of a settlement or in the center of village/village government which is used as a place for customary trials to resolve problems of violations of customary law. Bale Bonter also called is inauguration building and a storage place for historical objects or family heirlooms.</td>
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<tr>
<td>Bale Tani</td>
<td>Bale Tani is in the form of a pyramid which is used as the residence of the Sasak societies who work as farmers. Bale Tani has a dirt floor with rooms consisting of one room for the foyer (sesangkok), one room for the bedroom (dalem bale), and a cooking room/kitchen (pawon). Dalem bale is used as a place to store belongings (properties) owned or a girl’s bed. Other family are sleep in a sesangkok</td>
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<tr>
<td>Bale Jajar</td>
<td>Bale Jajar is a residential building for the Sasak societies of the middle to upper economic class. The shape of Bale Jajar is almost the same as Bale Tani and the only difference is the number of palaces. Bale Jajar has two rooms (dalem bale) and are separated by a corridor from Sesangkok to Pawon. buildings Bale Jajar are usually located in large residential complexes and are marked by the presence sambi as a storage area for household or other family needs.</td>
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<tr>
<td>Bale Tajuk</td>
<td>Bale Tajuk is one of the supporting facilities for residential buildings with large families. Bale Tajuk is pentagonal in shape with five pillars. Usually in the middle of a family environment and used as a place for large family meetings and training to add insight and manners.</td>
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</table>
Bale adat (traditional house) is still used by living monument as a place to live and as a cultural heritage/tourist destination, such as Sade Traditional Village (Widianti, 2017). The materials for making traditional house still follow hereditary teachings by using natural materials that are often found around the community, such as wood, bamboo, reed leaves, and tree sap which function to clean the house and prevent insect attacks (Wir’aeni, 2017; Muliadi et al., 2022). Widianti (2017) further emphasized that the floor of the house is made from a mixture of soil, tree sap and ash which is then smeared with buffalo dung. According to local residents, buffalo dung functions as a soil moisture remover, so residents have a distinctive habit of mopping floors using buffalo dung every two weeks (Wir’aeni, 2017; Widianti, 2017).

Widianti (2017) explains that traditional house of all types uses main poles made of gahil wood, the walls are made of woven bamboo (bedek). To connect the wooden parts, they use bamboo nails. Meanwhile, the roof and ridges are made of straw or reeds and thatch (Muliadi et al., 2022). The use of materials for making Bale adat (traditional house) contains indigenous science that can be developed in science learning on the concept of network structure and function, as well as the concept of material properties and their use in everyday life (Zubaidah et al., 2018). Thus, science learning based on Sasak Traditional House can build meaningful learning ethnoscience (Akmal et al, 2020) and can construct science competence in the process, product, and attitude dimensions (Ali, 2018; Wahyu, 2017). This is confirmed by the results of Emdin's research (2011) that meaningful learning experiences can increase student competence, because they can increase student motivation and enthusiasm (Damayanti et al., 2017). According to Chiapetta & Koballa (2010), one very important dimension in studying ethnoscience-based science is to construct the relationship between science and technology and society (Parmin, 2017).

**Opportunities for the Implementation of Ethnoscience-Based Science Learning**

Ethnoscience as a set of knowledge owned by communities, ethnic, and nations in an area which is obtained by certain methods that are traditional and empirically, the truth of which can be tested and accounted for (Sudarmin, 2014). Indigenous science in the culture and traditions of the Sasak societies can be taught in science lessons (Parmin, 2017). This is confirmed by the opinion of Sudarmin et al. (2017) that local culture found in society can be used for education or learning. Indigenous science contained in the culture and traditions of the Sasak societies such as songket motifs, making poteng jaje tujak, and materials for making bale adat can be integrated into science learning at schools (Sudarmin et al., 2018). This is supported by the opinion of Chiapetta & Koballa (2010) that one of the important dimensions in studying natural science is to construct the relationship between science and technology and society. Thus, learning science based on indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat is important for students to build an attitude of loving culture and local wisdom through introducing the cultural potential of the Sasak societies (Sudarmin et al., 2019; Parris & Linder-Van Berschot, 2010). Indigenous science as indigenous knowledge of local communities is effective in developing students' tolerance for the diversity of local cultures and traditions in each region (Hikmawati et al., 2020; Akmal et al., 2020; Wahyu, 2017). Based learning science of the culture of the Sasak societies can fortify students from acculturation of foreign cultures transformed by today's very massive electronic media (Sudarmin, et al., 2019; Mardianti et al., 2020). Thus, Ethnoscience-based science learning can construct students' knowledge comprehensively about indigenous science contained in its culture and traditions and avoid alienation from its own environment (Parmin, et al., 2017; Wahyu, 2017; Listyawati, 2012). According to Krajcik et al. (1999) that ethnoscience-based learning is more oriented towards an integrated (interdisciplinary) understanding rather than just an in-depth understanding (Chiapetta & Koballa, 2010).

Natural Science learning based on indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat in building process skills and forming scientific attitudes (Mardiana, 2018), as well as developing mastery of concepts related to everyday life (Suastra, 2009). This is in accordance with the opinion of Ali (2018) that science learning is expected to be a vehicle for students to learn about the natural surroundings and prospects for further development in everyday life. The process of learning science based on indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat will provide direct experience for students in developing competencies and understanding the natural surroundings scientifically (Rizkianawati et al., 2014). Thus, indigenous science in songket motifs, making
poteng jaje tujak, and materials for making traditional house can be carried out through a project-based learning (Zulfa, et al., 2022; Samsudin, et al., 2020; Sudarmin et. al, 2019; Afriana, Permanasari & Fitriani, 2016) to build students' direct experience of culture and traditions (Kubicek, 2005) and increase creativity and thinking skills (Ummah et al., 2019; Anazifa & Djukri, 2017). In addition, Indriani (2013) explained that indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat models' scientific inquiry to foster creative thinking and literacy skills (Suryadari, et al., 2018; Rizkianawati et al., 2014).

Natural Science learning based on indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat is expected to develop product dimensions, processes, attitudes, procedures, and technology (Ali, 2018; Chain & Evan, 1990). This is possible because indigenous science is contextual in nature which facilitates the active involvement of students to interact with concrete objects in everyday life (Ali, 2018; Mardiana, 2018; Rizkianawati et al., 2014; Koes, 2003). Khoiri & Sunarno (2018) emphasized that science learning must be contextual in order to be able to present natural phenomena in people's lives in every science concept learning activity (Khoiri & Sunarno, 2018; Setyowati et al., 2013). Learning science in songket motifs, making poteng jaje tujak, and materials for making bale adat can facilitate students to gain direct experience in exploring and applying science concepts related to culture in everyday life (Puspasari et al., 2019). This learning activity certainly allows students to think scientifically about indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat (Listyawati, 2012; Seroto, 2012; Kartono et al., 2010). This is in accordance with the opinion of Toharudin, et al. (2017) that local culture and traditions that characterize the Sasak societies contain indigenous science (Rahayu, et. al., 2021; Ardianti, et. al., 2019; Sudarmin, et. al., 2019; Setiawan, et. al., 2017) can be learned in the concept of natural science (Wati et al., 2020; Khoiri & Sunarno, 2018; Sudarmin, Sunarni & Mursiti, 2018). Thus, integrating indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat in science learning can present contextual learning, accommodate regional specificities, comprehensively explore the dimensions of natural science, and prevent the loss of cultural and traditional uniqueness in an area. (Kasa, 2011).

Integrating indigenous science in songket motifs, making jaje tujak poteng, and materials for making bale adat in the IPA concept can be carried out in stages, namely (1) Observation, gathering information on indigenous science in songket cloth motifs, making jaje tujak poteng, and materials for making bale adat; (2) Transformation, mapping the IPA concept that is relevant to indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat; (3) Integration, reconstructing learning relevant science concepts by integrating indigenous science in songket motifs, making poteng jaje tujak, and materials for making bale adat. The potential for integrating the concept of science learning in indigenous science-based schools in the motif of songket cloth, making poteng jaje tujak, and materials for making bale adat is presented in the following table 2.

<table>
<thead>
<tr>
<th>Indigenous science</th>
<th>Scientific Science</th>
<th>Basic Competency of Science Learning in School</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of kayu galih as the main pillar of the Bale so that it is study and durable</td>
<td>Secondary growth is caused by the activity of the vascular cambium, causing an increase in the amount of vascular tissue in the stem. In general, the secondary growth of the vascular cambium produces continuous loops of xylem and phloem and causes changes in the dense texture of the interior of the stem.</td>
<td>Analyzing the interrelationships of plant tissue structures and their functions, as well as technologies inspired by plant structures</td>
</tr>
<tr>
<td>The use of woven bamboo sticks as material for bale adat walls so that they are not quickly damaged by heat and rain water</td>
<td>Bamboo are strong enough from rainwater and hot temperatures because the bamboo stems contain silica, namely one of the inorganic materials that has the advantage of having high stability against mechanical influences, temperature, and acidity conditions</td>
<td>Connecting the concept of matter particles, the structure of simple substances with the properties of materials used in everyday life, as</td>
</tr>
<tr>
<td>Use of bamboo sticks as nails between poles</td>
<td>Buffalo manure contains silica (SiO2) which can have pozzolanic properties so that it can serve to glue and harden the floor surface of bale adat such as cement.</td>
<td></td>
</tr>
<tr>
<td>The use of woven reed stems as roofing material for the bale adat so that they are not quickly damaged by heat and rain water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The use of buffalo dung to smear the Bale to prevent it from getting damp, broken, and dusty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Indigenous science

- The Wayang motif is reconstructed from a sketch of a human couple and an umbrella in the process of marriage (*nyongkolan*); cape flower petals sketch
- The Subahmale motif is reconstructed from sketches of cape flower petals and *kenanga* flower
- Motif Keker reconstructed from a sketch of a pair of peacocks and a tree branch
- Motif Four Star is reconstructed from a sketch of a morning star and a fried flower crown
- Motif *Alang/Lumbung* is reconstructed from sketches of the *Alang/Lumbung*, tanjung flower petals, and *kenanga* flower
- Poteng Reket is a typical food of the people of Lombok which is produced based on conventional biotechnology
- The basic ingredients are sticky rice, tape, clean water
- The procedure for making the sticky rice is washed and soaked in clean water for 4-5 hours; sticky rice is steamed until cooked; after that it is cooled and leavened; incubated for about 2 days.

### Scientific Science

- The petals and corolla are the structures of the generative reproductive organs of plants
- Petals and *kenanga* flower are the characteristics of spermatophyte plants
- In the process of making *poteng jaje tujak*, a fermentation reaction occurs. The reaction that occurs in the process of fermenting cassava into tape is glucose (C6H12O6) which is the simplest sugar, through fermentation it will produce ethanol (2C2H5OH) and carbon dioxide (CO2).

### Basic Competency of Science Learning in School

- Analyzing the reproductive system in plants and animals and applying technology to the reproductive system of plants and animals
- Applying the concept of biotechnology and its role in human life

## Conclusion

Based on the results and discussion, it is concluded that (1) the nature of learning science can be classified into three dimensions, namely science as a product, science as a process, and science as an attitude; (2) indigenous science in *songket wayang* motifs, *subahmale* motifs *keker* motifs *four star*, and *alang/lumbung* which have relevance to the basic science competence of “analyzing the reproductive system in plants and animals and the application of technology to the reproductive system of plants and animal”; (3) indigenous science in the materials for making traditional house has relevance to the basic competence of natural science on “analyzing the interrelationships of plant tissue structures and their functions, as well as technology inspired by plant structures”; (4) indigenous science in the process of making *poteng jaje tujak* has relevance to the basic competence of natural science regarding “applying the concept of biotechnology and its role in human life”.

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## Author Contributions

M. Harja Efendi: developing literature study topics, defining literature analysis methodology, analyzing literature related to literature study topics.

Agus Muliadi: browsing and mapping literature related to the topic of literature study, writing draft articles, revising, and editing final articles.

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## Conflicts of Interest

The authors declare no conflict of interest.

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