

# The Integration of Javanese Indigenous Knowledge in Biology Learning Resources Development

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**Abstract.** The student's difficulties in learning and understanding Biology concepts are caused by the adoption of scientific phenomenon that not suitable with the environment they live in. Students who comes from the Javanese background sometimes find the Biology concepts hard to understand. Science content that comes from the West sometimes is not suitable with the student's background, because the cultural and geographical background that underlining the science development are different. It can potentially cause the clash in constructing knowledge of students. The proportion of western knowledge and indigenous knowledge has to be balanced, in order to give the scientific rationale of the natural phenomenon that faced by students in everyday life. The ethnoscience experienced by student is still in the form of concrete experience as a result of the interaction with the nature. As one of the largest tribe in Indonesia, Javanese has many unique cultures that can be adopted in science classroom especially in Biology class. The role on ethnoscience in the context of developing Biology learning resources is to connect the science concept with the real world situation. By considering indigenous knowledge as one of learning resources, teachers can start to adjust the Javanese indigenous knowledge into the curriculum. This paper is literature review which will present the background, rationale, and procedure in integrating Javanese indigenous knowledge into Biology classroom as learning resources. The integration of Javanese indigenous knowledge in Biology learning resources development is necessary in order to connect the Biology concept into real situation.

## 1. Introduction

The development of science and technology has affected to Biology material taught in school. Scientific phenomenon taught in Biology is adapted from the West that sometimes are different with the condition where the students come from. It is caused by the concepts are taken from the West that has different background with the students. The difference between the natural phenonemon presented in Biology teaching and learning with the natural phenomenon that usually faced by students can possibly caused the clash in building knowledge.

Learning Biology should be able to educate student to learn about their soroundings. It is called as contextual learning ehich students learn based on the reality they usually found in everyday life. Students need to know about the natural phenomenon in their environment and also learn about the ethnical prespective or traditonal knowledge that accompanies the phenomenon. But a lot of traditional knowledge is also being lost because of the communication gap, since neither children nor adults spend as much time in their communities. Because it is generally transmitted orally, it is susceptible to change, particularly when people move to new regions, or when people's lifestyles tend to be different from that of their ancestors.



Indonesia is an incredibly diverse country. It consists of many tribes and ethnics. One of the biggest tribes in Indonesia is Javanese tribes. It is centred in Central Java, Yogyakarta, and East Java province of Indonesia, but due to migrations it can also be found in other parts of the Indonesia and even in the other parts of the world. Javanese tribes has a variety of cultures. The majority of Javanese livelihood is farmers. The Javanese farmers has its own method in managing their farmland by using its indigenous knowledge called as *pranotomongso*. This paper will explain about the background, rationale, and procedure in integrating Javanese indigenous knowledge into Biology classroom as learning resources. The integration of Javanese indigenous knowledge in Biology learning resources development is necessary in order to connect the Biology concept into real situation.

## 2. Method

This study was a qualitative study. Data were collected using library study by analysing books, journals, and other sources from the internet. This study aims to analyse the background, rationale, and procedure in integrating Javanese indigenous knowledge into Biology classroom as learning resources.

## 3. Discussion

### 3.1. Indigenous Knowledge

Every culture has its own science and refers to the science in a given culture as its indigenous science [1]. In the last 25 years, biologist, ecologist, botanist, geologist, climatologist, astronomers, agriculturist, pharmacologist, and related working science have labours to develop approaches that are improving our ability to understand and mitigate the impact of human activity upon the environment [1]. Scientist has formalized a branch of biological and ecological science that has known as traditional ecological knowledge (TEK). Indigenous science is the interpretation of the nature phenomenon based on particular culture perspective, whereas traditional ecological knowledge is both the science of long-resident oral peoples and a biological sciences label for the growing literature which records and explores that knowledge [1].

Ogawa defines indigenous science is a culture-dependent collective rational perceiving of reality where collective means held in sufficiently similar form by many persons to allow effective communication, but independent of any particular mind or set of minds [1]. Indigenous science, sometimes referred to as ethnoscience, has been described as the study of systems of knowledge developed by a given culture to classify the objects, activities, and events of its given universe [2]. Indigenous science interprets how the local world works through a particular cultural perspective. It has also been referred to as the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area [3].

There are differentiation between formal knowledge and indigenous knowledge. Fromal knowledfe is developed within predominanty western- based education system. It is called as a formal because it is supported by written documents, rules and regulation, and technological infrastructure. On the other hand, the difinition of indogenous knowledge is the knowledge practiced and maintained by people with long histories of close interaction with natural phenomenon. Indigenous knowledge is fundamental to local decision-making regarding daily activities like hunting and gathering, fishing, agriculture, animal husbandry, water conservation, health, etc. Moreover, unlike formal scientific knowledge, indigenous knowledge is generally transferred as oral wisdom from one generation to the other, and is seldom, if ever, documented. Combining all forms of knowledge other than the formal ones as 'indigenous knowledge' would lead to its generalization and oversimplification, and may negate the outstanding contribution local knowledge can make to sustainable development [3].

In the recent years, indigenous knowledge has been applied in various filed including intercropping techniques, pest control, crop diversity, and seed varieties in agriculture; plant varieties, and fish breeding techniques in biology; traditional medicine in human healthcare; soil conservation, irrigation, and water conservation in natural resource management; and oral traditions and local languages in

education. The realization of indigenous knowledge's contribution to these sectors has led to an increasing interest in it by academicians, and also policymakers.

### 3.2 *Biology Learning Resources Development*

Indigenous knowledge has been incorporated in modern applied sciences such as medicine, architecture, engineering, pharmacology, agronomy, animal husbandry, fish and wildlife management, nautical design, plant breeding, and military and political science. One example that can be used as one of Biology learning resources is pranotomongso system. *Pranotomongso* is a system that regulates the work of Javanese farmers based on the change of the season [4]. *Pranotomongso* consists of two words, *pranoto* which means determination and *mongso* which means season. *Pranotomongso* has been known by Javanese farmer since longtime ago. They had known the planting time and the rest time for farmland. *Pranotomongso* can be used as a conservation mode in a traditional way.

Pranotomongso is divided into 12 mangsa in a year. There are kasa atau kaji (I), karo (II), katelu (III), kapat (IV), kalima (V), kanem (VI), kapitu (VII), kawolu (VIII), kasanga (IX), kasapuluh (X), dhesta (XI) dan saddha (XII). Pranotomongso is also divided into four big seasons. There are katigo, labuh, rendheng, and mareng. Every each big season is divided into three months. Katigo is divided into kaso (kasa), karo, dan katigo (katiga), while labuh is divided into kapat, kalimo (kalima), kanem. rendheng is divided into kapitu, kawolu (kawalu), kesongo (kasanga), whereas mareng is divided into kesepuluh (kadasa), apit lemah (hapitlemah), apit kayu (hapitkayu). Every month has its own characteristic that can be noticed by the natural changing of the environment as a basis to start farming [5].

Pranotomongso is one of indigenous knowledge relating to the agriculture. The application of pranotomongso shows that Javanese people are connected to the environment since long time ago. Javanese people see the nature as a subject that they are bent down to the nature. They also think that the change of the season is determined the activities they should do in terms of agriculture [6].

Pranotomongso had been used as a season determination since Hindu era in Java Island. In that time, people commonly used Saka calendar as a calendar system that made by Aji Saka, the king of Medang Kamulang, so that people called pranotomongso as mongso. As the Islamic era started to spread in Indonesia, Saka was changed into Hijra system that automatically affecting the usage of mangsa system. Javanese people started to leave the mangsa system [7]. Pranotomongso was standardized in June 22<sup>nd</sup> 1856 by Sri Susuhunan Paku Buwana VII in Surakarta that divided into 12 mangsa or 12 months with 23 until 43 days in a month [8]. Pranotomongso was also written in Serat Centini written in 1820- 1822 by Paku Buwono V. It was published in The History of Java and Hien. In that time, pranotomongso was only used by Javanese people around Merapi Mountain and Merbabu Mountain. The standardized of pranotomongso aimed to strengthen the calendar system used to guide the farmer in managing their farmland based on the natural phenomenon that has been divided into mangsa.

Pranotomongso has cosmographic aspect and bioclimatology aspect. Both of them are underpinning the life of Indonesian in social aspect, economics aspect, and cultural aspects. Pranotomongso uses natural phenomenon as farming time direction. There are many natural phenomenon used in pranotomongso, such as plants conditions, bedidig phenomenon, the distinct temperature change in the beginning of dry season, animal behaviours, and astrological signs. The utilization of these natural phenomenon can be used as determinant to start farming.

There are many similarities between pranotomongso and Georgian calendar system. The similarities are on the length of sun radiation, average temperature, average humidity, and evapotranspiration throughout the years that are relatively low. The similarities can also be seen through the cosmography method used in both calendar system. Indonesian had started to use this knowledge from the ninth century until Mataram sultanate as a direction in agriculture, economic, administration, and military.

Besides described as cosmography, pranotomongso is also explained as bioclimatology. Mangsa kasa, sotya murca ing embanan, depicts the fallen leaves. The natural phenomenon that can be seen during this season is that the leaves start to fall, the land begins to dry, and the water begins to shrink.

Mangsa Karo, bantala rangka, can be seen as the palawija plants and other plants such as randu and manggo trees start to grow, and the land begins to crack. Mangsa Katigo, suta manut ing bapa, means that lung-lungan plants start to spread. Mangsa Kapat, wasspo kumembang jroning kalbu, means that the sources begin to dry. This is the harvesting time for palawija plant and also the growing time to other plants such as uwi, gadung, kunci. Mangsa Kalimo, pancuran emas sumawur ing jagad, means that the weather begins to cold, tamarin trees start to grow, and animal such as snake and flies start to appear. It is also harvest time for mango. Mangsa Kanem, rasa mulyo kasucen, can be described as fruits season when rambutan, durian, and manggis begin to ripe. Mangsa Kapitu, wisa kentar ing maruto, means that it is a rainy season when farmers begins to plant paddy. Mangsa Kawolu, ajrah jroning kayun, means that it is a happy season when the weather is quite warm and the paddy field turns into green. Mangsa Kasongo, wedare wacana mulya, means that during this season there is a sound of cicada. Mangsa Kesepuluh, gedong minep jroning kalbu, means that it is a harvest time for paddy and nesting and hatching time for birds. Mangsa Dhesto, sotya sinarawedi, means that in this month, farmers start to harvest their paddy, pala pendhem, and tubers. Mangsa Soddha, tirta sah saking sasana, means that the weather begins to cold.

Pranotmongso shows the spirituality that shows respect and appreciation to the earth in which human live. Earh is an subject not an object. Pranotmongso shows us that human can not be sparated to the earth, so that human needs to know the place where they live in including the natural phenomenons that show the natural hange as a sign for the chhange of season. Pranotmongso also shows that Javanesse farmer dares to live from the earth spirituality by catching the natural phenomeneons. It is based on the mutal relationship between human and nature.

Pranotmongso is one of indigenous knowledge from Javanesse tribes that can be used as a reflection to others in order to learn the environmental change. Their understanding of natural phenomenon and natural behaviour is formulated into their argicultural system. Pranotmongso also helps farmes manage thir economic life by looking at their crops in every season. Pranotmongso is also called as ethnoscience that develop in Javanesse tribe. Ethnosisnce studies about the structure used in managing the environment that is consided as a concrete experience and what is important in the certain ethnic. In Javanesse tribe, ethnosicene is still in a form of concrete experience as a result of interaction between human and environment. The development and the utilization of ethoscince can be described as follows, it begins from the interaction between human and envrionment, then it becomes as an etnic knowledge that can be analysed through the ethnoscience prespective. Moderenization and rasionalizaionethnic knowledge through ethnoscience prespective is done afterwards. The next step is the development of ethnic knowledge and followed by the empowerment of ethnic knowledge. [7].

The application pranotmongso in agriculture is necessary that pranotmongso brings a local knowledge that is able to overcome agriculture problems such as the effective use of agricultural land and the high demand for food. Pranotmongso must be reinstated in the right place, so that local knowledge is still be used in the right proportion, such as the integration of pranotmongso in science learning and the guidance for local farmers in managing thier farmlands using pranotmongso.

Indigeous science, pranotmongso, can be used as learning resources in Biology teaching and learning, particullary in developing material for environment theme and ecosystem theme that includes conservation and environmental management. By using pranotmongso as a learning resources, it can teach students about conservation. In pranotmongso, there are environmental management concepts that can educate students to preserve the environmental functions. It can be usefull for farmes to manage and mantain thier plantation based on its characteristic towards the nature. In addition, by implementing pranotmongso, farmers also conducts the intercropping method in order to inhibit the soil damage. It also can improve sustainable production in plants and improve the ecological condition of the land.

Learning using indigenous knowledge is one of the examples of contextual learning. Students will learn through the biological phenomenons that usually happen in their environment they live in. In addition, learning using indigenous knowledge, it gives the opportunities to educators to modify the curriculum based. The indigenous knowlege can be adapted into the curriculum. The curriculum can

be developed based on student's backgrounds. It also opens up the opportunities to make innovations in education based on local wisdom. Students can learn based to their own tradition [9].

Indigenous knowledge or local wisdom can be embedded and integrated in curricular programs using integrated model the existing curriculum, and or subjects that exist, even learning process. Curricular courses or subjects should be loaded with the values of local wisdom. This model requires the readiness and capability of school, the principal and teachers. School principals and teachers are required to be creative, full of initiative, and also rich in ideas. Teachers and principals must be clever and deft in order to describe the curriculum, to manage learning, and develop assessment. The advantages of this model are cheap and does not add the workload of principals, teachers or learner [10].

#### 4. Conclusion

*Pranotomongso*, indigenous knowledge from Javanese tribes, can be developed as one of the Biology teaching and learning materials. The utilization of *pranotomongso* aims to preserve local wisdom and educate the students about conservation concepts of natural resources in the agricultural sector. *Pranotomongso* can also be used as a reference for the various natural phenomena that are expected to emerge in response to weather conditions or climate change. By using *pranotomongso* as learning resources in Biology teaching and learning, it can educate people in understanding the biological phenomena well, because people should be able to adapt with the environmental changing.

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