



Increasing the Capacity of Teachers and Students in Understanding the Concept of Environmental Awareness of Honey Bee Cultivation

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Abstract: Bees are honey-producing insects from the genus *apis*. In addition to honey, bees also produce pollen, royal jelly, propolis, beeswax and bee venom. Honey products that are widely found in Indonesia come from local honey bees, superior bees, wild bees, and lanceng bees. The high demand has driven up the price of honey bee products. Propolis has various health benefits such as containing high antioxidants and phenols, so it has the potential to cure various diseases such as toothache, influenza, diabetes mellitus, tuberculosis, and others. The purpose of this community service is to provide assistance to students regarding environmental awareness of honey bee cultivation at the Pattimura University Laboratory Middle School, Ambon and to increase the capacity of teachers in understanding the concept of environmental awareness of honey bee cultivation. The steps taken for learning honey bee cultivation use Project based learning (PjBL).

Keywords: Conceptual understanding; Honey bee culture; Environmental awareness

Introduction

According to Koetz, (2013) that honey products that are widely found in Indonesia come from the following honey bees: 1) Local Bees (*Apis cerana*). The distribution of this type of local honey bee is found in almost all regions in Indonesia. Honey production for this type of bee is between 6-12 Kg per year for each colony (Buchori et al., 2022); 2) Superior Bees (*Apis mellifera*). Superior bees were first introduced in Indonesia in 1841 and have developed to this day. This type of honey bee is a favorite of beekeepers. This is because the production of this type of honey is very high, reaching 35-40 kg per year per colony. In addition, from the aspect of bee cultivation, superior types have good adaptability to various types of climates so that the potential for bee migration is minimal (Landaverde et al., 2023); 3) Wild Bees (*Apis dorsata*). Wild bees are only found in the forests of subtropical and tropical Asia. This type of bee

has not been cultivated until now because of its very wild and fierce nature. The body size of wild bees is larger than other types of bees (Iwasaki & Hogendoorn, 2022); 4) Lanceng bee (*Apis trigona*). Lanceng bee is the bee with the smallest body size compared to other types. This type of bee is relatively tame and has no sting. The production of this type of honey is relatively small, namely 1-3 kg per year for each colony. While propolis production is around 2 kg per year per colony (Salatnaya et al., 2020).

The high demand has driven up the price of honey bee products. However, many people are still reluctant to cultivate honey bees because they think that cultivating honey bees is a difficult, complicated, and dangerous activity because bees have a poisonous sting (Pucca et al., 2019; Shanahan, 2022). Based on these problems, stingless honey bee cultivation is a very attractive alternative for anyone who wants to increase their income or start a business. The popularity of

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stingless bee cultivation has increased rapidly after information emerged that these bees can produce 4 times more propolis than *Apis* bees (Melia et al., 2024).

Propolis has various health benefits such as containing high levels of antioxidants and phenols, so it has the potential to cure various diseases such as toothache, influenza, diabetes mellitus, tuberculosis, and others (Nisa & Kustiawan, 2023). *Trigona* sp. or commonly known by the public as klanceng bees are bees that do not sting and their life does not only depend on flower pollen like other types of honey bees (Agussalim et al., 2015). With its unique nature, *Trigona* can be bred anywhere and is spread throughout Indonesia including urban areas provided there is a source of resin or sap from surrounding trees to be able to produce propolis in its nest (Pratama et al., 2018).

Local content on honey bee cultivation as study material that forms an understanding of the potential in the region (Suartha et al., 2023). The school environment and their residence are useful for providing students with attitudes, knowledge, and skills so that they: 1) know and become more familiar with honey bees; 2) have the ability, skills and knowledge regarding honey bee cultivation that are useful for themselves and the community in general; and 3) have attitudes and behaviors that are in line with the values/rules that apply in their area, as well as preserving and developing the noble values of Maluku culture in order to support national development.

The multicultural diversity in Indonesia, especially in the Maluku region, local honey bees are a characteristic that enriches the values of the lives of the Indonesian people, especially the Maluku people (Batlolona & Klean, 2023). Therefore, this diversity must always be preserved, developed and maintained through educational efforts. (Leasa & Batlolona, 2023). Permendikbud Number 79 of 2014 concerning study materials or subjects in educational units containing content and learning processes about local potential and uniqueness. This is intended so that students develop an understanding of the advantages and wisdom of the area where they live. The policy related to the inclusion of local content on honey bee cultivation in the content standards is based on the fact that in Indonesia there are diverse cultures in Maluku, especially the city of Amnon. The school where the education program is implemented is part of the community. Therefore, an education program to empower the environment, especially honey bee cultivation in schools, needs to provide students with broad insight into the specificities of their environment. Introduction to environmental, social, and cultural conditions, especially music, to students allows them to become more familiar with honey bee cultivation.

Introduction and development of honey bee

cultivation is directed to support the improvement of human resources quality, and ultimately directed to improve the ability of students. The content standards that are entirely prepared by the central government cannot possibly cover the local content. Therefore, it is necessary to prepare subjects based on the local content of honey bee cultivation in basic education. The local content of honey bee cultivation provides opportunities for students to develop their abilities and skills.

Therefore, the local content of honey bee cultivation must include local cultural characteristics, skills, noble values of local culture and raise social and environmental issues that are ultimately able to equip students with basic honey bee cultivation skills as provisions in life, and can create jobs. The purpose of this service is provide assistance to students regarding environmental awareness of honey bee cultivation at the Pattimura University Laboratory Middle School, Ambon and increase teacher capacity in understanding concepts environmental awareness of honey bee cultivation.

Method

Preliminary Study

The views of several experts then, it can be concluded that creativity is an attribute that is inherent in a person when a person is able to produce something new through a process of attitude change because of a motivation to accept novelty with various possibilities that exist to produce a better product. Creativity or creative thinking skills have become important skills to adapt quickly in changing the world of education.

Preparation for Community Service Activities

The steps taken for learning honey bee cultivation based on Project based learning (PjBL) are as follows; 1). Analysis of school objectives and characteristics, 2). Analysis of learning resources in this case the results of educational research on honey bee cultivation based on PjBL 3). Analysis of student characteristics in the area Pattimura University Laboratory Middle School, Ambon, 4). Determining the targets and contents of learning on honey bee cultivation based on PjBL, 5). Determining the strategy for organizing the contents of learning on honey bee cultivation based on PjBL, 6). Determining the strategy for delivering the learning contents, 7). Determining the learning management strategy, and, 8). Developing the procedure for measuring learning outcomes. Steps (1), (2), (3), and (4) are the steps for analyzing learning conditions, steps (5), (6), and (7) are the development steps, and step (8) is the step for measuring the results of learning on honey bee cultivation based on PjBL.

Implementation of Community Service Program

The structure of the training and mentoring program is implemented with an in-service training pattern that is carried out in a classical presentation, as well as an on-the-job learning pattern or independent mentoring is carried out at the training participant's place of work as an implementation of the training. This service is intended to obtain a honey bee cultivation learning design model based on PjBL in an effort to improve students' creative thinking skills according to student needs, namely arousing curiosity, questions, investigating, carrying out authentic activities, and creating, not just replicating existing knowledge (Ningsih et al., 2020). This service is a development activity that is directed to develop students' creative thinking. The object of this service is the development of a honey bee cultivation model based on PjBL for students in Junior High School Laboratory Pattimura University, Ambon. This service involves 1 lecturer and 5 doctoral students of Biology Education. The location of the school used as the service location is Junior High School Laboratory Pattimura University, Ambon.

The socialization pattern is carried out in 1 material orientation and 1 field practicum in the school's forest environment. The training activity is planned to last 80 minutes, equivalent to 2 hours of lessons and 80 minutes of practicum. All socialization materials are presented in the form of power points (PPT). Practical activities are carried out using student worksheets (LKPD) based on PjBL. The PjBL approach used in socialization is based on student activity, so that students are not only passive in receiving material transfers from resource persons but are actively making products. The model developed is a PjBL-based honey bee cultivation learning model.

In this socialization, lecturers and students as partners play a role in providing their main participation and proposed community service activities and implementing knowledge from the training in their respective schools. The success of the socialization is marked by the increasing awareness and creativity of students about PjBL-based honey bee cultivation. As a form of continuity of this technical guidance, the action activity of making Boxes (stup) and Extractors Boxes (stup) and Extractors with students and lecturers of the S1 Biology Study Program who focus on ongoing mentoring under the coordination of the Biology study program.

Program Sustainability Plan

Long-term planning and follow-up are related to program management, the next partner involvement is to hold creativity training for students, especially honey bee cultivation training and resource persons are S1 Biology education lecturers. The sustainability plan is one of the guarantees for the sustainability of the

program. With the follow-up plan, it will be more facilitate the implementation of the program in the future. Not only related to the forms of follow-up programs, but also the forms of intervention of other parties to organize similar programs. It requires careful planning to be able to prepare a good follow-up plan according to the program based on the potential and strengths owned. In addition, it also requires consideration of assets that have been owned and will be developed. This includes human resources as an asset for coordination and collaboration.

Based on the above, here are some follow-up plans for the program implemented through training and mentoring of students together with teachers in honey bee cultivation by carrying out activities including:

- a. Guide students and teachers to do Technical guidance on how to cultivate Apis Cerana honey supports local content subjects based on project-based learning Pattimura University Laboratory Middle School, Ambon as a learning resource for students.
- b. Guide students and teachers to make boxes (stup) and extractors
- c. Guide students and teachers to do pPreparation of fishing equipment such as nest combs, box supports, rubber gloves, hats & masks, levers, smoker bee brushes
- d. Guide students and teachers to do ppreparation of fishing equipment such as hats and masks, levers and bee brushes
- e. Guide students and teachers to make arrestsbee
- f. Guide students and teachers to carry out maintenancebee
- g. Guide students and teachers to harvest honey

Results and Discussion

General Description of Socialization Activities

The Community Partnership Program (PKM) activity is in the form of a workshop with the theme "Technical Guidance on How to Cultivate Apis Cerana Honey Bees to Support Local Content Subjects" Unpatti Ambon Laboratory Middle School," will be held offline on Friday, October 6 2023 at Unpatti Ambon Laboratory Middle School cooperation as a partner. The participants of this technical guidance activity are 3 grade 7 teachers, Unpatti Ambon Laboratory Middle School from all subjects. The event starts from 10.00 – 15.00 WIT.

The socialization was attended by 3 teachers and 25 students, with the following agenda:

1. Opening and introduction between the resource person and the workshop participants.
2. Greetings from the Principal Unpatti Ambon Laboratory Middle School
3. Entering the core event of the workshop which consists of 2 sessions, each session is filled by

different speakers and materials, the following speakers and materials presented in Table 1.

Table 1. Workshop Activity Material: How to cultivate Apis Cerana Honey Bees

Source person	Material
Prof. Dr. Pamela Mercy Pampilaya., M.Pd	Creative thinking skills and students' conceptual understanding based on local wisdom in Maluku
Ir. Jacobus SA Lamerlabel, MP	Technical methods for cultivating Apis cerana honey bees
Preilly MJ Tuapattinaya., S.Pd. M.Pd	Think creatively and innovatively

After the presentation of the material by two speakers, the event continued with a question and answer session guided by the moderator. There were questions represented by each group submitted by workshop participants, including: Questions in the socialization of honey bee cultivation in Pattimura University Laboratory Middle School, Ambon Friday 8 August 2024 includes:

1. Question from Student 01: What are the contents of honey?

Honey bees are social insects rich in benefits. Everything produced by honey bees is known to be beneficial for health. Bees convert saccharides into honey by chewing them repeatedly until they are half digested. But this process does not happen all at once, after being chewed the saccharides are still in liquid form and still contain a lot of water, so the next process is evaporation as much as possible and transformation with enzymes. This is done by bees as a reserve when in winter or when food is scarce. According to research by experts, honey has various mineral contents and contains seven B complex vitamins and contains vitamin C. Honey has been known for thousands of years. Many people know its benefits. Proper management of honey bee colonies can only be done if beekeepers have in-depth knowledge of various management strategies.

2. Question from Student 10: What are the side effects of bee therapy?

Although it offers many benefits for treating various types of diseases, bee stings contain substances that can cause...allergic reaction in some people. The allergic reaction can be fatal. Even for people who are not allergic, bee sting therapy still carries the risk of side effects, such as itching, swollen skin, headaches, coughing, uterine contractions, yellowing of the skin (*jaundice*), pain, and muscle weakness. If you decide to undergo bee sting therapy, consult your doctor to the doctor first. Make sure bee sting therapy is performed by

a certified professional who understands the side effects and risks of this alternative treatment method.

3. Question from Student 20 that is Why must bee sting therapy use bees that produce honey?

Bee sting therapy can also be used as an alternative medicine in treating neurological diseases, such as Parkinson's disease and multiple sclerosis. The benefits of bee sting therapy for treating these diseases are thought to be related to the effects of bee venom which has anti-inflammatory properties. Bee venom (apitoxin) contains many active biological compounds. Among its contents are amino acids and enzymes that have anti-inflammatory properties. These enzymes can reduce pain and speed healing. This therapy is done by placing bees on a person's skin (Ullah et al., 2023).

4. Question from Student 21: How long does it take to cultivate honey?

Keeping stingless honey bees is very safe because you don't have to be afraid of being stung and you don't have to herd them, with a harvest time of only around 4-6 months. The development of stingless bee colonies can be helped by planting food sources and resin as their resources. If the dry season is short enough in one year, harvesting can be done 6-7 times. While if the dry season is long enough, harvesting is only done 4-5 times. The amount of honey produced in each harvest is also different (Salatnaya et al., 2020).

5. Question from Teacher 01

The next step is to start implementing honey bee cultivation so that there is sustainability so that students will be more independent in applying honey cultivation knowledge in everyday life. Bees are animals that produce nutritious food and have high economic value, namely honey, propolis, nectar and royal jelly. The high demand has driven up the price of honey bee products. However, there are still many people who are reluctant to cultivate honey bees because they assume that honey bee cultivation is a difficult, complicated and dangerous activity because bees have poisonous stings. Based on these problems, stingless honey bee cultivation is a very attractive alternative for anyone who wants to increase their income or start a business (Luthfi Hana Fadiah & Ateng Supriyatna, 2023). The popularity of stingless bee farming has increased rapidly after information emerged that these bees can produce 4 times more propolis than Apis bees. Tips for Successfully Starting a Honey Bee Farming Business for Beginners include: (1) Focus on one business opportunity; (2) Do what you love; (3) Master everything about your business; (4) Always want to learn from others; (5) Live simply; (6) Learn from failure; (7) Show that your business concept is the best; and (8) Stay healthy.



Figure 1. The following is documentation of the activities of students from Unpatti Laboratory Middle School together with teachers and resource persons carrying out cultivation practices based on project-based learning.

Like other invertebrates, honey bees are also poikilothermic animals; they cannot regulate their body temperature and must undergo a period of inactivity when the atmospheric temperature is intolerable. Honey contains sugar and high nutritional value. In addition to sugar, other components are also contained in honey. Such as minerals, polyphenols, vitamins, amino acids, carotenoids, enzymes, organic acids, and volatile compounds. Bee brood contains sufficient amounts of protein and is non-toxic, so it can serve as a direct food

source when the beekeeper does not need or needs more bees or additional brood, or when unwanted colonies must be removed. (Paray et al., 2021). The results of the study showed that fresh honey bee brood is rich in protein (16%), fat (3.7%), carbohydrates (4.1%), fiber (0.7%) and ash (0.9%). Several minerals were detected in honey bee brood, namely K, Na, Fe, Cu, Zn and Mn, in quite large amounts. Vitamins (A, B1, B2, B6, B12 and C) were also detected in significant concentrations (Abd Al-Fattah et al., 2009). Traditional uses and clinical

applications of bee honey and stingless bees – such as antimicrobial, antioxidant, anti-inflammatory, anticancer, antihyperlipidemic, and cardioprotective properties; treatment of eye disorders, gastrointestinal diseases, neurological disorders, and fertility disorders, as well as wound healing activities (Rao et al., 2016).

Honey is a viscous solution containing a variety of molecules, including fructose and glucose (80–85%); water (15–17%); ash (0.2%); proteins and amino acids (0.1–0.4%) and small amounts of enzymes, vitamins, and other substances, such as phenolic compounds. However, the composition of honey varies depending on the type of plant from which the bees consume nectar. Nevertheless, almost all honeys worldwide contain the same types of phenolic acids, including caffeic, ellagic, ferulic, and p-coumaric acids; flavonoids, such as apigenin, chrysin, galangin, hesperetin, kaempferol, pinocembrin, and quercetin; and antioxidants, such as tocopherols, ascorbic acid, superoxide dismutase (SOD), catalase (CAT), and reduced glutathione (GSH). Each constituent has unique nutritional and medicinal properties, and these components work synergistically, making honey useful in a variety of applications (Patricia et al., 2015).

In addition, honey bees are also considered to be the world's main pollinator workers, contributing, together with other pollinators, to 35% of global food production (Klein et al., 2007). Honey bees belong to the insect order Hymenoptera, family Apidae, subfamily Apinae, and tribe Apini. Apini consists of only a few species, of which four, namely *Apis mellifera*, *A. cerana*, *A. dorsata*, and *A. florea*, are dominant. The European (or Western) honey bee *A. mellifera* is the most commonly used species worldwide in commercial beekeeping practices (Ghosh et al., 2021).

Conclusion

The conclusions drawn are as follows; 1) Increasing the capacity of teachers and students in understanding concepts Environmental awareness of honey bee cultivation at SMP Laboratorium Unpatti Ambon is very useful in developing mlocal honey bee cultivation as a study material that forms an understanding of the potential in the region in this case the school environment and their place of residence is useful for providing provisions for attitudes, knowledge, and skills to students so that: (1) they know and become more familiar with honey bees; (2) have provisions for abilities and skills as well as knowledge about honey bee cultivation that are useful for themselves and the community in general; and (3) have attitudes and behaviors that are in line with the values/rules that apply in their region, as well as preserving and

developing the noble values of Maluku culture in order to support national development; 2) The program follow-up plan is implemented through training and mentoring of students together with teachers in honey bee cultivation by carrying out activities including: (a) Guiding students and teachers to carry out technical guidance on how to cultivate *Apis Cerana* honey to support local content subjects based on Project based learning Unpatti Laboratory Middle School; (b) Ambonas a learning resource for students; (c) Guide students and teachers to make boxes (hives) and extractors; (d) Guide students and teachers to prepare fishing equipment such as nest combs, box supports, rubber gloves, hats & masks, levers, smoker bee brushes; (e) Guide students and teachers to prepare fishing equipment such as hats and masks, levers and bee brushes; (f) Guide students and teachers to catch bees; (g) Guide students and teachers to maintain bees; and (h) Guide students and teachers to harvest honey

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