






Analysis of Mina Padi Innovation Village based on local wisdom as a learning resource assisted by biological simulation applications

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ABSTRACT

Mina Padi Innovation Village was a potential village for natural resources in cultivating rice and fish on the same agricultural land. The innovation villages studied in this study were Janten and Margoluwih villages, which had different topography. This study aims to analyze the local potential of Mina Padi ecosystem found in Janten and Margoluwih villages as a learning resource in ecology courses, third semester biology education students by integrating project learning and utilizing biology simulation applications in learning activities. This study used descriptive qualitative and exploratory methods. Data collection techniques used observation, identification, and documentation. The result of local potential was in the form of utilizing village natural resources into an innovative agricultural land, which has its own peculiarities different from other villages. The local potential of Mina Padi innovation village was in accordance with the study of structural and functional concepts of ecosystem, community and population ecology, freshwater aquatic habitat ecology, and artificial ecosystem. The local potential of Mina Padi innovation village has the potential to be a source of ecological learning material.

Keywords: ecology, ecosystem, local, Mina Padi, village potential

INTRODUCTION

Indonesia is a country that has abundant biological and non-biological diversity. Several potential natural resources in Indonesia in the form of agriculture, plantations, animal husbandry, and tourism can be used as learning resources, by utilizing existing potential as a source of problems, ideas, or ideas in supporting the learning process. The curriculum currently initiated by the government, namely Merdeka Curriculum, emphasizes learning based on application in everyday life. Learning biology as a part of education has great potential in utilizing local potential as a source of learning. One of the provinces in Indonesia that has abundant natural potential is the Special Region of Yogyakarta (DIY). Kulon Progo Regency is one of the districts that drives the tourism sector in DIY. Based on data from the official website, Kulon Progo Regency has various types of tourism such as natural tourism, cultural tourism, special interest tourism, artificial tourism, crafts and others. One of the most common types of tourism in Kulon Progo is nature tourism, which is also a favorite tourist destination for most people, both from within and outside the city.

The natural wealth owned by each village in Kulon Progo Regency is different, as is the case in Janten Village, Temon District. Janten Village is a village in Kulon Progo Regency, which has vast agricultural potential. The biggest agriculture in Janten Village is rice plants by participating in cultivating fish on the same land, which is known as the Mina Padi system. This potential can be utilized to improve the economic sector and create its own branding for Janten Village and of course it can be a source of learning for students by observing the ecological conditions in the Mina Padi area. In addition, the activities of the Mina Padi program can maintain the balance of the ecosystem. This is due to the minimal use of pesticides on agricultural land filled with tilapia fish varieties. Janten Village is not far from the beach area so that the ecological condition of Mina Padi is also influenced by sea water salinity. Nonetheless, the people of Janten Village, Temon District, Kulon Progo Regency are able to produce large quantities of rice and fish.

Apart from the Janten Village area, Mina Padi program is also found in Margoluwih Village, Cibuk Kidul Hamlet, Sleman Regency, which is a pilot village for Mina Padi in Asia Pacific. The source of irrigation comes from Mataram Ditch, which always produces water in a constant amount so as to enable the fulfillment of water needs for the maintenance of fish and rice. Mina Padi program is a consideration for the intensification of modern agriculture, which uses a lot of pesticides. As a result, fish and freshwater animals that have traditionally been able to maintain the fertility of rice fields have died. Mina Padi program combines traditional wisdom and modern planting materials. The differences in environmental conditions found in Mina Padi areas in the

Temon and Cibuk Kidul areas deserve further investigation as a source of learning through the application of the contextual involve hands on ctivity by utilizing biology simulation technology in studying ecological material found by semester three students of the biology education study program.

The project-based contextual approach emphasizes the whole student involvement process to be able to find the concept of the material being studied by designing effective rice field modeling using biological simulation applications so that it can relate it to real life situations so that it encourages students to apply it in their lives and find solutions to the problems found. So that they can develop and empower their regional potential to be able to compete in the global era.

The innovative village of Mina Padi is empowering the natural potential of Janten Village and Margoluwih Village by managing it to become an ecosystem of rice fields and fisheries, which has a positive impact in terms of ecology, social and economy. Mina Padi ecosystem has a mutualistic symbiotic relationship between rice, fish, water, and soil to achieve ecological balance. Mina Padi can increase land productivity and is profitable from a social and economic perspective. From a social standpoint, Mina Padi can make farming something interesting, especially for the younger generation. Meanwhile, from an economic perspective, Mina Padi is very useful because it can increase people's economic income. Merdeka curriculum requires integration of aspects of character development in accordance with the profile of Pancasila students. The desired character development in learning is related to social attitudes, namely respecting and living honest behavior, discipline, responsibility, caring (tolerance, mutual cooperation). So the authors took the initiative to be able to find and develop the potential found in the innovative village of Mina Padi as a source of local potential-based ecosystem learning.

An object can be used and developed as a learning resource if it fulfills several criteria, namely:

- (1) clarity on the availability of objects and issues raised,
- (2) suitability of material objectives,
- (3) clarity of information disclosed,
- (4) clarity of exploration guidelines, and
- (5) clarity of acquisition to be achieved (Djohar, 1987).

Selection of learning resources should be based on the goals to be achieved in learning or competencies that have been formulated. Good learning resources ideally provide meaningful learning experiences for students, so as to improve students' thinking skills. This can be realized through a contextual approach by presenting concrete and authentic learning resources that are close to students through the use of local excellence-based learning resources. According to Najmulmunir (2010), design and learning resources used (by utilization). Designed learning resources (by design), is a learning resource specifically designed or developed as a component of an instructional system to provide directed and formal learning facilities, while the learning resources used (by utilization), namely learning resources that are not specifically designed for learning purposes and their existence can be found, applied and utilized for learning purposes.

The innovative village of Mina Padi as one of the local advantages of Kulon Progo Regency and Sleman Regency functions as a learning resource that is utilized (by utilization). This learning resource is not deliberately designed specifically for learning but can be used as a learning resource. In order for these learning resources to be meaningful to students, an analysis is needed to describe the potential of the Mina Padi Innovation Village as a source of ecosystem learning for third semester biology education students as a further reference for developing it into teaching materials.

METHOD

Types of research

This research is a preliminary study to determine the potential of Mina Padi Innovation Village as a source of ecosystem learning. This type of research is descriptive qualitative research, which is carried out through the analysis of potential learning resources. Analysis of potential learning resources is carried out through curriculum analysis by looking at the suitability of learning resources with the applicable curriculum.

Writing Material

This writing is descriptive analysis with the theme of analyzing the potential of the innovative village of Mina Padi (Janten Village, Temon District, Kulon Progo Regency and Margoluwih Village, Dusun Cibuk Kidul, Sleman Regency, Yogyakarta) as a learning resource assisted by biology simulation applications (PopGen and PlantSimLab Web Application).

Writing Goals

The target of this study is the activity of the innovative Mina Padi Village program (Janten Village, Temon District, Kulon Progo Regency and Margoluwih Village, Cibuk Kidul Hamlet, Sleman Regency, Yogyakarta) as a location for observational studies and 3rd semester biology education students in ecology courses.

Data Source

Data sources were obtained from the websites of Janten Village and Margoluwih Village for information related to population data and local potential. The basic theoretical studies compiled were obtained from books, journals, and web pages from the internet that support the writing of this article.



Figure 1. Map of the Coastal Landform Unit of Temon District, Kulon Progo Regency: Circled area is the Janten Village area (Source: Temon District Central Bureau of Statistics)

Data Collection Technique

The data collection technique used is interview technique, direct observation as primary data and literature review as secondary data by collecting various existing information and then developing it into a report. Analysis of local potential as a source of learning according to Suhardi (2012, p. 8) has several requirements, as follows:

- (1) clarity of potential,
- (2) compatibility with learning objectives,
- (3) clarity of material objectives,
- (4) clarity of information that can be disclosed,
- (5) clarity of exploration guidelines, and
- (6) clarity of expected gain.

Software Used

In writing this paper, the author utilizes two types of web-based applications that can be accessed free of charge to support the design and processing of ecosystem material reports, namely Corel Draw, PopGen, and Cell Collective applications.

RESULTS

The initial activity in the framework of analyzing the potential of the Mina Padi Innovation Village as a source of learning is to collect information related to the local advantages of Janten Village and Margoluwih Village through observation, interviews, and literature studies. Methods of observation (observation) as well as interviews were conducted with Mina Padi farmers in several Mina Padi agricultural areas in Janten Village and in Margoluwih Village, namely Cibuk Kidul Hamlet. The rice produced through Mina Padi is not only superior in quality, but also in quantity. Yields increased from an average of 6.5 million tonnes per hectare to 9.3 tonnes per hectare. Literature study was carried out by searching for information through various sources such as reference books, scientific journals as well as studying the documentation of Fish Farming–Kulon Progo Maritime Affairs and Fisheries Service. Based on the results of observations, interviews and literature studies, information was obtained in the form of facts and phenomena related to the potential of Janten Village and Margoluwih Village, namely as follows.

Potential of Janten Village

Janten Village profile

Janten Village is a village located in Temon District, Kulon Progo Regency, DaerahYogyakarta special (**Figure 1**). This village consists of 327 heads of families spread across five hamlets: Tegalsari, Tegalrejo, Janten, Dukuh, and Jomboran. These five hamlets are further divided into nine RTs and 16 RWs. Janten Village has a vision, namely “efforts to realize an independent Janten Village based on a people’s economy and development of local potential, religious characteristics, and a spirit of mutual cooperation with the support of information technology.” In achieving its vision, Desa Janten also has a mission, which is divided into eight points:

1. Improving the ability of the village to answer the basic needs of the community, which includes health, food, education and security needs towards an independent village synergized with the RPJMD in the government structure above it.

2. Increasing original income by increasing PERUMDES in the midst of the community and exploring other local potentials.
3. Increasing community participation/participation in the development of Janten Village.
4. Improving the quality of service to the community.
5. Facilitation of the Village Government in encouraging social spiritual activities based on mosques/mushollas and Islamic boarding schools.
6. Facilitation and motivation for empowering the people's economy in collaboration with multi-stakeholders.
7. Facilitating the development of education (formal and non-formal) in synergy with the environment (community-based) in empowering village libraries.
8. Facilitation village government in exploring and developing the preservation of cultural arts.

Village apparatus structure

The government of Janten Village is managed by 12 village apparatus, with one Village Head. Janten Village apparatus consists of the Lurah, Carik, Panata Laksana Sarta Pangripta, Danarta, Jagabaya, Ulu-ulu, Kamituwa, and five hamlets. Lurah is another name for the Village Head in Janten Village. The other structure organized by Panata Laksana Sarta Pangripta, Danarta and Jagabaya, Ulu-ulu and Kamituwa. The five hamlets in Janten Village are the Tegalrejo, Tegalsari, Janten, Dukuh, and Jomboran.

Geographic location

Geographically, Janten Village is located in the lowlands with an altitude of up to 100 meters above sea level. The boundaries of Janten village to the West, North, East, and South, respectively are the Karangwuluh Village, Kapanewon Temon; Hargomulyo Urban Village, Kapanewon Kokap; Kebonrejo Village, Kapanewon Temon; and Palihan Village, Kapanewon Temon. Janten Village is surrounded by rice fields and quite a lot of water sources.

Profession

Most of the people of Janten Village make use of existing natural resources, namely their rice fields. So, the work of most of the residents of Janten Village is farmers. The majority of the people's income depends on agricultural and fishery products.

Mina Padi

Mina Padi was chosen as the method We consider it appropriate to do this in Janten Village, Kulon Progo because based on the analysis that has been made, Janten Village is a village with a large percentage of paddy fields in the Kulon Progo area and access to water flow, which is sufficient to enable rice cultivation with Mina Padi system. This technique itself has quite a lot of benefits and can be used as an additional source of income and increasing rice growth because in addition to the rice planted, farmers also spread fish seeds for consumption on the edge of rice fields as a place for fish growth and this can also be used as a substitute for chemical fertilizers because fertilizer produced comes from fish waste contained in the water. The technique used to carry out the cultivation of Mina Padi is, as follows:

1. Land preparation:
 - a. Processing soil with a depth of 15-20 cm with a ratio of silt and water 1:1.
 - b. Paddy field bunds are made sturdy so that they do not leak and slide easily.
 - c. The width of the base of the bund is 40-50 cm, the top width is 30-50 cm.
2. Mina Padi container:
 - a. The enlargement container is a plot of rice fields that can hold water.
 - b. The container can be completely drained.
 - c. Separate entry and exit gates.
 - d. Tilted caren toward output channel.
 - e. The area of rice field plots is at least 500 m².
 - f. The bunds must be strong to hold water at least 30 cm from the paddy field with a minimum width of 50 cm.
 - g. Widecaren a minimum of 1.5 m with a minimum depth of 0.5 m from the court.
 - h. The minimum size of the cobblestone is 1.5 m × 1.5 m × 0.5 m.
3. Selection of fish seeds: The fish seeds used must choose seeds that are of high quality and have high economic value.
4. Selection of rice seeds: Examples of rice varieties used for Mina Padi cultivation system, namely:
 - a. Varieties of Inpari 14 Pakuan
 - b. Varieties of Inpari 15 Parahyangan
 - c. Varieties of inpari 16 Pasundan

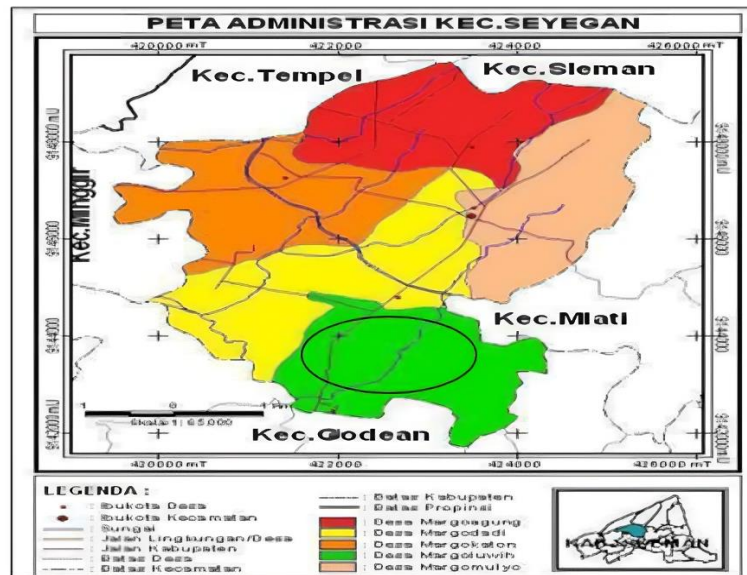


Figure 2. Landform Unit map of Seyegan District, Sleman Regency: Circled area is Margoluwih Village area (Source: Central Statistics Agency of Sleman Regency)

Potential of Margoluwih Village

Profile of Margoluwih Village

Margoluwih Village, Seyegan District, Sleman Regency has an area of ± 500 ha, consisting of 312 ha of agricultural land, 137 ha of property (yard) and 51 ha of other land (**Figure 2**). The total population of Margoluwih Village as of the end of December 2007 was 8,575 consisting of 4,367 men and 4,208 women spread across 14 hamlets divided into 75 RTs and 29 RWs with 2,248 families. The 14 hamlets are Klinyo, Klakap I, Klakap II, Klaci I, Klaci II, Klaci III, Ngentak, Barak I, Barak II, Cibuk Lor I, Cibuk Lor II, Cibuk Kidul, Mandungan I, and Mandungan II.

Region location

The location of the Margoluwih Village area, with an area of about 500 ha, is in the following geographical position:

- North: Margodadi Village.
- South: Sidoagung Village.
- East: Sidomoyo Village.
- West: Sidorejo Village.

Land use

Land in the village of Margoluwih consists of about 312.1975 ha of yard land, about 180.9898 ha of rice fields/agriculture. Public facilities, roads, cemeteries around 6.8127 ha.

Natural resource potential

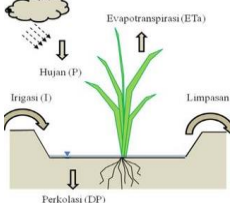






Margoluwih Village has natural resource potential, namely abundant water (South of Mataram Selokan), springs (source/bubble) and fertile agricultural land. Margoluwih Village is an agrarian village with abundant rice and fish yields.

Identification of Local Potential of Mina Padi Innovation Village

To find out the potential of the Mina Padi Innovation Village as a learning resource, the information collected through observation and literature studies is then adjusted to the syllabus curriculum for the third semester ecology course used, in this case the independent curriculum. The results of the suitability of the local potential of the Mina Padi Innovation Village with the undergraduate biology education study program curriculum are described in **Table 1**.

Mina Padi area can be used as a source of learning, especially to understand the mechanism of the nitrogen cycle involving biotic and abiotic components of terrestrial and freshwater aquatic. Nitrogen enters waters through nitrogen fixation and human activities (run-off from fertilization on agricultural or waste areas) (Brooker et al., 2010). Feeding in fish farming also causes the entry of N into the waters. Aquaculture has been considered an anthropogenic contributor to N_2O (potential greenhouse gas) emissions, which contribute to ozone depletion and environmental pollutant NH_3 , and both contribute to global climate change (Behera et al., 2013; Li et al., 2019). NH_3 evaporation is estimated to be 8-65.7% of the total N lost in aquaculture ponds, but it depends on the temperature and pH of the water (Gross et al., 2000; Hargreaves, 1998). This happens because the abundant N residue in ponds can cause N pollution in water bodies through waste disposal from aquaculture in the form of N_2O emissions and evaporation of NH_3 into the atmosphere (Li et al., 2019), leftover feed and waste from fish in the form of excretion waste contains phosphate, N ammonium and N ammonia (Hu et al., 2013).

Table 1. Results of the analysis of the local potential of Mina Padi with the biology education curriculum

Observed objects & symptoms	Potential used as a learning resource	Basic competencies
<p>Nitrogen cycle (terrestrial & aquatic) in rice Mina Padi ecosystem (Arief, 2015).</p> 	<p>Fact:</p> <ul style="list-style-type: none"> Nitrogen minerals available to plants are added to soil through solubility in rainwater, deposition of fine dust, or other grains. Nitrogen enters waters through nitrogen fixation & human activities. Giving fish feed causes entry of N into waters. <p>Biology problems:</p> <ul style="list-style-type: none"> What is role of nitrogen cycle as a limiting & regulatory factor? 	<p>Ecosystem as ecological unit: Ecosystem structures & bioenergetics. Biogeochemistry, limiting factors, & regulation.</p>
<p>Ciherang variety rice seeds (saprotan-utama.com)</p> 	<p>Fact:</p> <ul style="list-style-type: none"> Types of rice varieties Various potentials of rice <p>Biology problems:</p> <ul style="list-style-type: none"> What are different types of rice varieties? What exudate content in rice plants has potential as an energy source? 	<p>Community ecology: Community & diversity concept.</p>
<p>Tilapia seeds (gdmagri.com)</p> 	<p>Fact:</p> <ul style="list-style-type: none"> Diversity of tilapia species Various potential of tilapia (<i>Tilapia nilotica</i>) <p>Biology problems:</p> <ul style="list-style-type: none"> What are different species of tilapia? What are benefits of keeping tilapia for environment? 	<p>Community ecology: Community & diversity concept.</p>
<p>Mina Padi biocontrol (documentation)</p> 	<p>Fact:</p> <ul style="list-style-type: none"> Fish can be used as biocontrol in rice plants, rice benefits from fish by reducing attacks by insect pests, diseases, weeds, & can reduce growth of spores & mycelium caused by fish activity in water. <p>Biology problems:</p> <ul style="list-style-type: none"> What is role of biocontrol in Mina Padi ecosystem? 	<p>Population ecology: Population expression & growth. Fluctuations, control mechanisms in population, & population structure.</p>
<p>Mina Padi ecosystem (documentation)</p> 	<p>Fact:</p> <ul style="list-style-type: none"> Mutualism symbiotic relationship between rice, fish, water, & soil to achieve ecological balance. <p>Biology problems:</p> <ul style="list-style-type: none"> What is basic concept of ecology in Mina Padi ecosystem? 	<p>Artificial ecosystem</p>
<p>Mina Padi ecosystem (documentation)</p> 	<p>Fact:</p> <ul style="list-style-type: none"> Mutualism symbiotic relationship between rice, fish, water and soil to achieve ecological balance. <p>Biology problems:</p> <ul style="list-style-type: none"> What is basic concept of ecology in Mina Padi ecosystem? 	<p>Habitat ecology: Freshwater aquatic habitat</p>
<p>Mina Padi ecosystem (documentation)</p> 	<p>Fact:</p> <ul style="list-style-type: none"> Macroorganisms & microorganisms that live in freshwater aquatic habitats. <p>Biology problems:</p> <ul style="list-style-type: none"> What are macroorganisms & microorganisms that live in freshwater aquatic habitats? Are there differences in macro-organisms & microorganisms in freshwater aquatic habitats in coastal areas? 	<p>Habitat ecology: Freshwater aquatic habitat</p>

In the feed given to fish, only 25-30% of N and P in the feed is stored in fish (Bergheim et al., 1991), 25-30% is not eaten and is wasted into the environment (NCC, 1990; Rosenthal et al., 1988). The amount of N in fishpond cultivation shows that fish only absorb 11.6-46.5% of the N input in the feed, the rest is not digested, and discharged into the water and pond bottom (Hargreaves, 1998; Zhang et al., 2018), as shown in [Figure 3](#).

Rice-fish cultivation 11.1% of feed N is assimilated into fish bodies, 31.8% contribution to rice, and 57.1% returns to the environment. N feed that is not consumed by fish in rice-fish cultivation can be used by rice plants after experiencing indirect feed degradation (Hu et al., 2013).

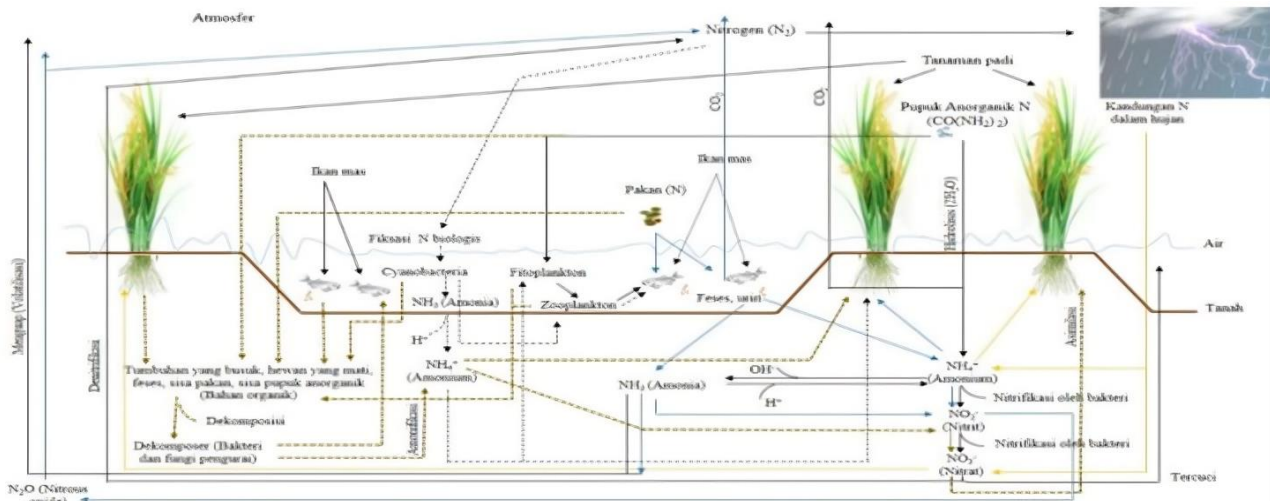


Figure 3. Cycle N on Mina Padi

(modified image from several sources: Brooker et al., 2011; Hu et al., 2013; Li et al., 2019; Singh, 2008; Taiz & Zeiger, 2010; Xie et al., 2011)

Table 2. Comparison of physical characteristics of Mina Padi area

Janten Village	Margoluwih Village
Lowlands with a height of 0-100 meters dpa with a slope of 0-2%. Located near the coast.	Lowlands with elevations above 100 meters above sea level with a slope of 0-2%. It is passed by Mataram Ditch and is flowed by the Krusuk River in Margoluwih Village.
The coastal area is 24.9 km long, so it is influenced by tides.	Topographical conditions are at an altitude of 167 meters above sea level and are not affected by tides.
Phylum proteobacteria, acidobacteria are abundant in sediment samples.	The phyla proteobacteria, acidobacteria, and chloroflexi were abundant in the sediment samples.
Phylum proteobacteria, Bacteroidetes were detected dominantly in rice mineral water samples.	Proteobacteria, bacteroidetes, and actinobacteria phyla were detected dominantly in rice mineral water samples.
Biogeochemical bacteria, such as desulfobacca in sulfate reduction, methylophilus in ammonia oxidation, and methylotenera in the carbon cycle and denitrification.	Biogeochemical bacteria, such as desulfobacca in sulfate reduction, methylophilus in ammonia oxidation, and methylotenera in the carbon cycle and denitrification.

In addition, rice-fish farming can significantly reduce N_2O emissions (Cheng-Fang et al., 2008; Wang et al., 2019). This shows that rice-fish cultivation can reduce the loss of N gas in aquaculture ponds and can reduce pollutant emissions into the atmosphere. Comparison of the physical characteristics of Mina Padi area in Janten Village and Margoluwih Village can be seen in **Table 2**.

Characteristics of Ecology Courses

Prerequisite courses: General biology.

Semester: 3.

Study program: Bachelor of biology education, Yogyakarta State University.

Competency standards: After attending ecological lectures, students are expected to understand basic concepts of ecology, able to apply them in uncovering ecological problems that occur in the environment and communicate them to fellow ecologists use a web-based virtual biology lab application.

The final ability planned is that students are able to study basic ecological concepts, which include ecology as a science, ecosystems as ecological units, community ecology, population ecology, habitat ecology, ecosystem evolution, and natural-built/artificial ecosystems. Activities to study these concepts through information, assignments, projects, modeling, discussions/presentations and clarifications. The learning activities carried out by students are, as follows:

- Stage 1.** Starting with the process of finding online learning resources, then reading online resources, mapping by sorting out needed and unnecessary learning resources, and finally finding the needed learning resources.
- Stage 2.** It starts with checking the content by adjusting the theory of subject matter, then checking the content creators by checking the academic background and finally checking the online media used.
- Stage 3.** Students carry out four activities, including parsing, sorting, differentiating and find or produce.
- Stage 4.** Students create a project model design by utilizing a biological simulation application.
- Stage 5.** Students design project models that have been designed using open source applications or other technological devices as presented in **Figure 4**.
- Stage 6.** Implement project design.
- Stage 7.** Consists of process evaluation and result evaluation.

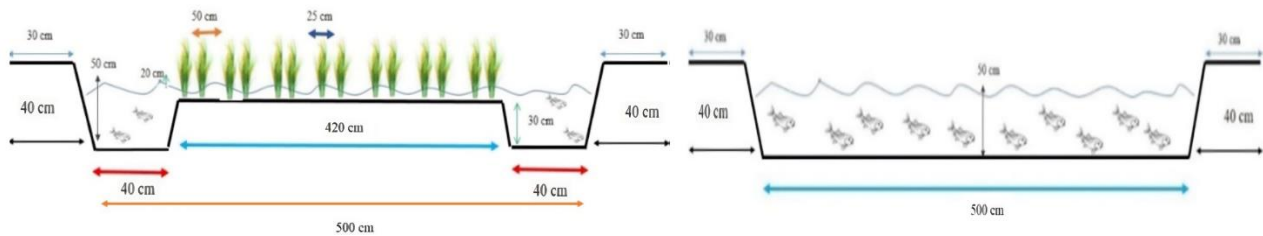


Figure 4. Students design a Mina Padi model (Astuti et al., 2020)

Local Wisdom

Based on the results of observations, analysis of the feasibility of learning resources and criteria for learning resources as well as their compatibility with basic competencies found local wisdom in the form of hereditary culture and beliefs found in the community, including the followings.

- a. When the farmers go down to the fields to start planting rice, within a week the residents are not allowed to cut down trees. The local wisdom of the people in Janten Village aims to maintain the blessings of the ancestors. If viewed scientifically, this plays a role in maintaining the availability of water in the rice fields.
- b. Construction of the base of the house that does not directly touch the ground so that the water catchment area and the water cycle in the environment are maintained. In addition, living things that live around the bottom of the house, such as worms, are not disturbed by their survival.
- c. The construction of houses that adapt to environmental conditions shows that traditional people have wise thoughts. This is in line with the opinion of Sartini (2004) that local wisdom is formed as a cultural advantage of the local community and geographical conditions in a broad sense.
- d. The community's habit of storing crops in a special place (granary), in accordance with the basic competencies of the ecology course requires students to be able to explain the interactions between living things and their environment. This interaction is illustrated by the human need for rice, which can be used as an example in learning human dependence on the environment.
- e. Apart from that, the wisdom of the people in building barns on the basis of not touching the ground is to protect the stored rice from being eaten by rats. The construction of granaries indirectly shows the existence of human dependence on natural resources in the environment.
- f. The community's habit of protecting bathing places and water sources as water reservoirs in accordance with the basic competencies of the ecology course requires students to be able to show respect for others in their daily activities as a form of implementation of behavior to maintain cleanliness and environmental sustainability. This is clearly illustrated by the attitude of maintaining the cleanliness of the environment around the bathing pool by giving it a fence as a sign that the pool is prohibited from being used carelessly as a form of mutual respect so that this attitude provides great benefits for the surrounding community to continue to enjoy clean drinking water sources.
- g. The function of the ditch as a source of water for residents indicates that there is a continuous interaction between the two in the form of maintaining water sources that are beneficial to environmental balance and meeting water needs that are beneficial to the surrounding community.

Local Potential

Based on the results of observations, feasibility analysis and criteria for learning resources as well as their compatibility with basic competencies, local potentials in the form of biological and non-biological resources were found, namely:

- a. Freshwater fish farming ecosystems, in accordance with basic ecological competencies, require students to be able to explain the interactions between living things and their environment. This interaction is clearly illustrated by the type of pond used in raising fish. The type of pond used is an earthen pond. An earthen pond is a pond made by digging the ground and filling it with water so that the walls and bottom of the pond are earthen. According to Majdi and Traunspurger (2015), pond bottom soil plays an important role in controlling water quality, eutrophication of plankton and bottom algae in ponds. The decomposition of organic matter and the resulting exchange of oxygen (benthic flux) and carbon dioxide are very helpful in providing nutrients. This indicates an interaction between environmental conditions and the availability of plankton as natural food for cultivated fish.
- b. Rice nurseries in nurseries in accordance with basic ecological competencies require students to be able to demonstrate scientific behavior (having curiosity, being objective, honest, thorough, meticulous, diligent, careful, responsible, open, critical, creative, innovative, and caring for the environment) in daily activities as a form of attitude implementation in observing, experimenting and discussing.
- c. Biodiversity around Mina Padi area requires students to be able to admire the order and complexity of God's creation regarding physical and chemical aspects, life in ecosystems, and the role of humans in the environment and to make it happen in the practice of the teachings of the religion they adhere to. Admiring God's creation is obtained from observing the regularity of the ecosystem and environmental management around the innovative village of Mina Padi, which shows the balance of God's creation for which we should be grateful.

Table 3. Compatibility of local potential with learning objectives (LO)

Local potential	Teaching materials	Compatibility of local potential with LO
Organic & inorganic components of rice paddy ecosystem.	Ecosystem as ecological unit: <ul style="list-style-type: none"> • Ecosystem structures & bioenergetics. • Biogeochemistry, limiting factors, & regulation. 	Students can understand basic concepts of ecosystems from structural & functional aspects.
Microcommunity & macroorganisms of Mina Padi ecosystem.	Community ecology: <ul style="list-style-type: none"> • Community & diversity concept • Patterns in community 	Students can understand basic concepts of community ecology.
Mechanism of control in rice populations on fish populations.	Population ecology: <ul style="list-style-type: none"> • Population expression • Growth fluctuations, & control mechanisms in population & population structure 	Students can understand basic concepts of population ecology.
Habitat of micro and macroorganisms of rice Mina Padi ecosystem.	Freshwater aquatic habitat	Students can understand concepts of habitat ecology freshwater aquatic.
Mina Padi Innovation Village (Janten Village & Margoluwih Village)	Artificial/agrarian built ecosystem	Students can understand basic concepts of ecology in various artificial ecosystems.

DISCUSSION

Potential Clarity

Clarity of potential shows that the object under study has potential as a source of learning and if the object it contains problems that can be revealed in a teaching and learning activity (Kurniawan & Utami, 2014, p. 73). The availability of objects in this study are components of macroorganisms and constituent microorganisms rice paddy ecosystem. The information raised in the research results is to look at differences in physical conditions and biological populations of Mina Padi ecosystem in areas affected by tides and lowland areas of fresh waters.

Compatibility With Learning Objectives

The suitability of learning resources with learning objectives should be selected based on what objectives will be achieved by using these learning resources. Population ecology examines the control mechanisms in populations. This study can be carried out by examining Mina Padi ecosystem, which has the same rice yield stability as the rice monoculture, as shown in **Table 3**.

The nature of the ecosystem that occurs in Mina Padi includes fish can be biocontrol in rice plants, rice benefits from fish by reduce attacks by insect pests, diseases, weeds, and can reduce the growth of spores and mycelium caused by fish activity in water on rice plants.

Potency of innovative village of Mina Padi, which is located in two separate areas, namely Janten Village and Margoluwih Village, can be utilized because the location of the two villages is not far from the Yogyakarta State University campus and safe travel routes. This is in accordance with the opinion of Husamah (2013, p. 13) that the determination of learning resource objects must pay attention to relevance to learning objectives and ease of reaching so students can enable them to learn them.

Utilization of innovative village of Mina Padi can support the achievement of learning objectives because students carry out learning activities in an orderly manner directly in the field (hands on activity) in accordance with the philosophy of naturalistic learning. This is in line with the opinion of Tarigan et al. (2021, p. 5) that learning objectives are learning outcomes that show students have carried out learning actions including new knowledge, skills and attitudes that are achieved by students.

Clarity of Material Targets

According to Kurniawan and Utami (2014, p. 73) the target in question is the clarity of the observation target (object) and designation target (subject). Clarity of observation targets (objects), namely the study of the mina ecosystem in two different areas, namely Janten Village (influenced by tides) and Desa Margoluwih (lowlands). The designation target (subject) is the 3rd semester students of the undergraduate biology education study program in the ecology course. This is in accordance with the results of the analysis, which have been verified that the local potential of Mina Padi Innovation Village is compatible with the target of ecological learning materials. This is in line with Febrita and dan Dahmania (2014, p. 49) environmental potential can be developed as a learning resource. The potential contained therein can be used as a source of ideas that can be developed to support the learning process.

Clarity of Disclosed Information

The clarity of the information revealed in this study is that Mina Padi is a model that is considered efficient and effective in irrigated rice fields with sufficient water availability during the growth of rice and fish. According to Cahyaningrum et al. (2014), the application of Mina Padi system is profitable, because farmers can obtain rice and fish at the same time. The time limit for raising fish in Mina Padi system is around 45-65 days. The limit of the maintenance period for this fish is closely related to the age of the rice. Mina Padi has several advantages including being able to optimize the benefits of land and water resources, reduce the use of pesticides (because it can reduce disease, pests and weeds in rice fields), reduce the application of N fertilizer, increase soil nutrients for rice plants, can solve certain problems caused by freshwater aquaculture, but the adoption rate in the world remains low so that sustainability is needed (Hu et al., 2015). The integrated cultivation system seeks to create a paddy field ecosystem.

Rice fields are an artificial ecosystem that provides habitat for several organisms such as plankton, which play an important role in freshwater ecosystems because they occupy a central position in the food chain, transferring energy from primary producers to organisms at a higher level (Chang et al., 2005). Naturally, fish obtain food from phytoplankton, zooplankton, plant residues, or aquatic plants such as Azolla (Taiz & Zeiger, 2010).

The excrement excreted by fish is a source of nitrogen for rice (Campbell et al., 2004). Fish droppings, residues of aquatic animals, plant residues will also be a source of organic matter for the soil, which can then be utilized by rice plants. The feed consumed by fish will be metabolized, causing growth and metabolic waste (ammonia and carbon dioxide). Feeding can cause food residue, namely food that is not eaten by fish. The remaining feed can cause a decrease in dissolved oxygen content in the water, the oxygen is used by bacteria that decompose leftover feed. Feeding can cause food residue, namely food that is not eaten by fish. The remaining feed can cause a decrease in dissolved oxygen content in the water, the oxygen is used by bacteria that decompose leftover feed. Feeding can cause food residue, namely food that is not eaten by fish. The remaining feed can cause a decrease in dissolved oxygen content in the water, the oxygen is used by bacteria that decompose leftover feed.

Clarity of Exploration Guidelines

According to Kurniawan and Utami (2014, p. 73) that the clarity of the exploration guidelines consists of the clarity of work procedures in the field starting from the determination of research objects, tools and materials, work methods, data analysis, and drawing conclusions. In this study the exploration of Mina Padi ecosystem can be utilized as a natural laboratory due to the availability of a practicum guide designed by the researcher. So, this is in line with the opinion of Sitanggang and Yulistiana (2015, p. 157), which states that learning can be done outside the classroom (outdoor education) by utilizing the environment as a natural laboratory.

Expected Earnings Clarity

According to Kurniawan (2010) that the clarity of acquisition in question is the acquisition of cognitive, affective, and psychomotor. The local potential of Mina Padi Innovation Village can be used as a biology learning resource because it is expected to be able to acquire cognitive, affective, and psychomotor aspects. The acquisition of the cognitive aspects obtained in the utilization of Mina Padi Innovation Village is that students are able to think at a higher level to gain knowledge by describing, classifying and analyzing the characteristics of physical properties and the interactions between biotic and abiotic factors that occur in Mina Padi ecosystem. Affective acquisition, namely students can be honest, conscientious, disciplined, work together, and be responsible for the results of activities and have positive scientific attitudes such as guarding, nurturing, and make good use of nature and the environment. The acquisition of psychomotor aspects, namely students can be skilled in using tools and organizing research data by making observation tables, designs, and technology-based models and can train students' independence in accordance with the times. This is in line with the opinion of Mumpuni (2012, p. 828) that local excellence-based learning resources will be able to increase students' knowledge, attitudes and skills.

Local potentials that are used as information in learning resources can present facts and environmental conditions so that students can relate ecological theory concepts to existing environmental facts, so that more meaningful learning will be obtained. This is in accordance with the opinion of Oktavianto and Handayani (2017, p. 39), which states that the application of a contextual approach by exploring local potential will assist educators in associating learning materials, so that learning will be more meaningful, and students can develop abstract ideas and their application in everyday life. Students' knowledge of local potential can increase understanding of concepts and improve students' environmental care attitudes.

Learning with a contextual approach can integrate the concept of conservation in ecological learning as an effort to foster environmental literacy and awareness. This opinion is also clarified by Machin (2014, p. 29), which states that environmental-based character education (environmental conservation) is one of the four types of conservation character that can be developed during the educational process.

Students' skills in identifying problem objects in the field can also be developed in the learning process. This is in line with Lase et al.'s (2016, p. 101) opinion, which states that the use of local potential in learning trains students' abilities to socialize and solve problems as a prerequisite for science process skills. This is also supported by Ibrohim (2015, p. 16) that learning science/biology can develop students' critical thinking skills, namely being able to compare or differentiate, examine small parts and the whole by using various regional potentials.

A positive attitude about local potential will also be formed so as to develop life skills. This is supported by the opinion of Masitoh et al. (2009, p. 13), which states that the curriculum implemented in accordance with the potential and characteristics of the region is a life skills-based curriculum. Students are brought to acquire a number of knowledge, attitudes, and skills about something related to the potential of the area they have so that the meaningfulness of the learning process carried out is based on the life experiences of students in the surrounding environment so that you know more closely the potential of the area.

CONCLUSION

Based on the results of the analysis of local potential, it can be concluded that the facts and problems related to the Mina Padi ecosystem are appropriate or related to the basic competencies of the ecology course in the independent curriculum so that they can be used as a reference for the development/packaging of teaching materials based on local excellence. Further efforts are needed to package/develop biology teaching materials based on local excellence that are tailored to the learning needs and characteristics of students.

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