# Integration local potential "Ketingan Tourism Village" in science learning to improve critical thinking and scientific literacy based on the nature of science framework

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# Integration Local Potential "Ketingan Tourism Village" in Science Learning to Improve Critical Thinking and Scientific Literacy Based on The Nature of Science Framework

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**Abstract.** This study aims to develop science learning by integrating the local potential of the Ketingan Tourism Village (KTV) in Yogyakarta as a learning resource for the interaction of living things topic, knowing its effectiveness on students' critical thinking skills and scientific literacy. To develop these learning tools used the Plopms' model. Learning is done by involving students' experiences as part of the learning process related to local potentials that are used as learning resources. The students' critical thinking and scientific literacy data were obtained using the Test Critical Thinking Skill in Science (TCSS) and Test on Scientific literacy (TSL), respectively. In addition, an Observation Sheet on Critical Thinking Skills (OSCTS) was prepared to observe students' critical thinking during the learning process. Descriptive Statistics and normalized gain technique were used to examine the influence of teaching learning on students' critical thinking and scientific literacy in this instructional learning. The findings revealed that the teaching with experiential learning model based on "Ketingan Tourism Village" has a high category on N-gain of scientific literacy, however medium on students' critical thinking. Students have a better to show scientific data and evidence, but it was less on doing investigation and explain the relationship content and phenomena. Meanwhile, for critical thinking, students have better to inference the phenomena and less on analysis it in science learning process. It is meaningful to promote students critical thinking skills and scientific literacy to create appropriate learning based on the nature of science framework using local potential as a resource in the learning process

## INTRODUCTION

Science learning as Integrative Science is carried out in an integrated manner which means combining various aspects, namely the domain of attitude (affective), knowledge (cognitive), and skills (psychomotor) [1]. Science learning must be applicative oriented, the development of thinking skills, learning abilities, curiosity, and the development of caring and responsible attitudes towards the natural and social environment developed in science learning so that meaningful learning will be created. To create meaningful learning in science learning cannot be separated from doing learning that is able to achieve Nature of Science (NOS), by involving students in the learning process and in finding knowledge and involving phenomena and experiences in everyday life to find out scientific truths through investigation activities [2].

NOS is a key component in improving students' scientific literacy. Many efforts to reform science education have been carried out to create a science-literate society, one of which is by emphasizing an understanding of NOS and learning by doing [3]. Scientific literacy ability of each individual is important to be developed and mastered by students, especially in understanding the environment, other problems in their environment, the ability and creativity of individuals to use their scientific knowledge and skills in solving problems, especially

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those related to everyday life, as well as making accountable decisions with the aim that each individual is able to face complex global challenges [4-6]. Literacy is important because it helps students in addressing and making decisions related to science issues in everyday life and can develop knowledge, skills, and use science as citizens and as individuals [7]. Science is not just a subject matter content, but is a knowledge construction process. Science can explain what scientific knowledge should be, establish hypotheses and identify problems, conduct reliable research methods, and draw conclusions based on testable evidence. scientific literacy is very important for science education [8]. Research shows that the overall scientific literacy profile of prospective science teacher students in Indonesia is still low [9]. Several factors that can affect students' low scientific literacy include the low level of student cognitive, rarely independent scientific investigation activities, the lecture process does not support increasing scientific literacy and learning approaches that do not support increasing scientific literacy. Therefore, science learning must be in accordance with the NOS framework to create learning that is able to fostering scientific literacy.

Encouraging students to think and work on their own initiative, to be objective, honest, and open as a form of scientific work is the essence of learning in NOS framework [10]. This is reinforced in the 21st century science learning designed with an approach that is able to facilitate higher order thinking skills to overcome global problems and be able to understand science through the discovery process [11]. One of the higher orders thinking skills is critical thinking. Critical thinking is one of the important learning outcomes in the 21st century [12]. The development of critical thinking skills has received less attention from teachers in the field, learning not only focuses on providing concepts but also laws, theories, and memorization, while students lack knowledge of the relationship between the concepts studied and their application in everyday life [13]. Thus, science learning should be designed and implemented through approaches, strategies and methods that can meet the contextual so that students can deal with real problems in their environment to support the formation of knowledge, values, attitudes, and skills with activities that are not only minds on but also hands on.

One of the learning models that prioritizes experience as a learning resource is Experiential Learning (EL). Experiential Learning by Kolb's model is divided into two modes of acquiring experience, namely, concrete experience and abstract conceptualization and two modes of transforming experience, namely, reflective observation and active experimentation [14]. In EL models concrete experience that requires full participation of individuals in the activity, while reflective observation requires individuals to develop various perspectives, abstract conceptualization requires attainment of the theoretical knowledge by the individual and active experimentation requires individuals to implement the knowledge [15]. Experiential Learning is learning that emphasizes challenges and experiences followed by reflection on the learning outcomes gained from these experiences [16].

Experience that can be used as the best source of learning is student interaction with phenomena that exist around students, one of which is local potential [17]. Strategies for creating learning environments and designing learning experiences that integrate local potential as part of the science learning process will create meaningful learning [18] and enhance scientific literacy, it is mean that learning science carried out in accordance with Nature Of Science (NOS) [5]. Local culture and potential as a result of the creation of human taste and initiative that develops as indigenous knowledge which is transformed into scientific science, furthermore the identified local potential phenomena will be investigated for scientific truth so that the knowledge found by students is obtained [19-20].

Local potential in Indonesia, especially Yogyakarta is very diverse. This can be used as a learning resource in science class. Students will be able to maintain the existing local potential and understand the science content in it so that it will create science learning in accordance with the NOS framework. One of the local potentials in Yogyakarta is the Ketingan Tourism Village (KTV). This area is very potential as a learning resource for the interaction of living things and their environment. However, in the field science teachers have not implemented learning by utilizing local potential around them, so there are still few related learning tools and resources. To facilitate learning that integrates local potential to improve scientific literacy and critical thinking skills, appropriate learning tools are needed. This study aims to design learning that integrates local potential so that it can train students' critical thinking skills and scientific literacy and knowing the effectiveness of science learning based local potential toward critical thinking and scientific literacy.

## METHOD

This study used the Plomps' Model [21] with 5 steps namely 1) preliminary investigation, 2) design, 3) construction, 4) test evaluation and revision, 5) implementation. Preliminary investigation is a stage to determine needs and problems in developing learning that integrates local potential to grow scientific literacy and critical thinking skills in science learning. At this stage an analysis of the curriculum, teaching materials and analysis of student characteristics is carried out by collecting information that supports learning by integrating the local potential of the KTV. The design phase is carried out to design learning tools (namely lesson plan and student's

worksheet) that integrates local potential of the Ketingan tourism village as a learning resource to improve students' scientific literacy and critical thinking skills. Prototype lesson plan and student worksheet are produced in construction step. The fourth stage the prototype that has been produced is validated by experts and then revised according to suggestions from the validator. After the product is declared feasible, a trial of the product is carried out in the field to determine its effectiveness in improving scientific literacy and students' critical thinking skills. Prototype tested on science learning in junior high school in Yogyakarta with 35 students of grade seven using one group pre-test post-test design. Finally, the last product by revision will be implemented in the other class in huge area.

Data of learning tools that integrates KTV as learning resources in science analysed by quantitative descriptive with percentage of eligibility of learning tools. The product is considered to be deserved as a good category if the validation rating achieves ≥69%. While the students' critical thinking and scientific literacy data were obtained using the Test Critical Thinking Skill in Science (TCSS) and Test on Scientific literacy (TSL), respectively. In addition, an Observation Sheet on Critical Thinking Skills (OSCTS) and Observation Sheet on Scientific literacy (OSSL) were prepared to observe students' critical thinking during the learning process. Furthermore, descriptive statistics and normalized N-Gain technique were used to examine the influence of teaching learning on students' critical thinking and scientific literacy in this instructional learning.

## RESULTS AND DISCUSSION

### Learning Tools based on Ketingan Tourism Village as Learning Resource

The Special Region of Yogyakarta is one of the provinces that has a lot of interesting local potential to be developed. The diversity of local potential that is owned can be an added value in various fields. One of the interesting potentials to be developed is a tourist village. A tourist village is a village that utilizes elements of local potential to be developed into integrated tourism products. The emergence of tourist villages creates a sense of love for the region and builds local independence to move forward. The tourist village puts forward culture and maintains local wisdom which is the main attraction for visiting tourists. The existence of the local potential of the tourist village triggers researchers to be able to develop aspects that they have so that they can be utilized and studied in classroom learning.

Preliminary research results indicate that Ketingan Tourism Village (KTV) is one of the tourist villages in Sleman Regency which has a unique natural attraction compared to other tourist villages. The village is a fauna tourism village that has a variety of biodiversity that deserves to be studied. People not only learn about this egret but also enjoying traditional arts in the form of *gejog lesung*, *jathilan* to performances of *pek bung* (traditional musical instrument that is beaten and made of *kelenting*). The presence of egrets living side by side with the surrounding community is an interesting phenomenon. The village community still maintains local potencial that makes the village known by many people, making it a tourist area. Not only biodiversity, the traditions of the surrounding community to preserve the environment and culture should be used as examples in learning activities. The existence of the local potential of the tourist village becomes interesting to be applied in the process of learning activities, so that students are expected to be able to present a real-life atmosphere according to the relevant material. Ketingan tourism village is very potential as a learning resource for the interaction of living things and their environment.

Through experiences in the KTV, students can find out the science concepts involved in it, especially for the interaction of living things and their environment. In the learning process, teachers need to facilitate learning by presenting the local potential through appropriate ones, for example presenting learning video teaching materials related to the local potential. Learning that integrates experience will create meaningful learning and in accordance with the NOS framework [22], it is hoped that it will facilitate the development of students' critical thinking and literacy skills [23][24]. This is due through learning resources that come from experiences or phenomena around students, they will understand nature and be able to analyze content related to learning [25]. To facilitate learning that integrates local potential Ketingan tourism village to improve scientific literacy and critical thinking skills, appropriate learning tools are needed.

The content set forth in the instructional tools in Ketingan Tourism Village theme is developed based on Core Competencies (CC), Basic Competencies (BC) and indicators such in Junior High School grade seven based on curriculum in Indonesia, as seen at Table 1.

**TABLE 1.** Analysis of Curriculum on the Theme " The Interaction of Living Things and their Environment "

| CC | BC | Indicator of Learning |
|---|---|---|
| 3. Understanding knowledge (factual, conceptual and | 3.7 Analyzing the interactions between living things and their | 3.7.1 Predicting environmental characteristics<br>3.7.2 Distinguish between biotic and abiotic definitions<br>3.7.3 Find examples of biotic and abiotic components |

| CC | BC | Indicator of Learning |
|---|---|---|
| procedural) based on his curiosity about science, technology, art, culture related to visible phenomena and events. | environment as well as population dynamics due to these interactions | 3.7.4 Predicting the units of life stage of an organism<br>3.7.5 Formulating the meaning of interaction<br>3.7.6 Arrange the order of the food chain in the environment based on reading material "Ketingan tourism Village"<br>3.7.7 Analyzing the role of a living thing in food web events based on reading material "Ketingan tourism Village"<br>3.7.8 Analyzing the relationship between the number of living things in the food pyramid and their impact on other living things based on reading material "Ketingan tourism Village"<br>3.7.9 Connecting the interrelationship of the role of a living being to other living things in a symbiotic interaction pattern of mutualism<br>3.7.10 Connecting the interrelationship of the role of a living thing to other living things in the symbiotic interaction pattern of parasitism<br>3.7.11 Connecting the relationship of the role of a living thing to other living things in the commensalism symbiotic interaction pattern<br>3.7.12 Analyzing living things based on the ability to make food<br>3.7.13 Analyze living things based on the type of food |
| 4. Trying, processing and presenting in the realm of the concrete (using, unraveling, arranging, modifying, and making) and the abstract realm (writing, reading, counting, drawing and composing) according to what is learned in school and other sources in the same perspective /theory. | 4.7. Presenting observations on the interaction of living things with the surrounding environment | 4.7.1 Observing the interaction of living things with the environment in the Ketingan Tourism Village that can affect the ecosystem<br>4.7.2 Make a poster about the interaction of living things with the environment in Ketingan Tourism Village that can affect the ecosystem |

In this study, the development of science learning tools that integrate local potential is carried out. Learning tools that consist of lesson plan, student worksheet and learning resource validated by expert.

Aspects of the lesson plan that are validated include the completeness of the lesson plan components of learning objectives, scenarios that integrate local potential. Meanwhile, the student worksheet includes student worksheet components, investigative activities that develop scientific literacy and critical thinking, material content that integrates local potential and appearance. And the last relates to learning videos that integrate the Ketingan tourist village assessed from the suitability of the video content with local potential, the content of the material, and its visualization. The scores of the feasibility lesson plan, student worksheet and video teaching materials are 89.8%, 89.7% and 87.3% respectively. Overall, the validation results from the expert for all aspects in the category are very good. It is necessary to emphasize the aspects of literacy and critical thinking skills which are marked in activities.

## Effectiveness of Scientific literacy

To find out the effectiveness of the learning tools in enhance science literacy and critical thinking students. A trial was carried out in junior high schools' grade seven. It's conducted by one group pre-test post-test design. Data of Test Scientific Literacy (TSL) of knowledge and Observation Sheet on Scientific Literacy (OSSL) of attitude, competence and context can be presented in Table 2 dan Table 3.

**TABLE 2**. Data of Observation Sheet on Scientific Literacy (OSSL)

| Aspect | Score (%) | | | Average (%) |
|---|---|---|---|---|
| | 1st meet | 2nd meet | 3rd meet | |
| Explain Scientific Phenomena | 83 | 85 | 92 | 87 |
| Evaluate the investigation | 77 | 83 | 85 | 82 |
| Show Scientific Data and Evidence | 83 | 85 | 89 | 86 |
| Explain relationship between concept and local potential | 79 | 84 | 88 | 84 |

**TABLE 3** Data of Test Scientific Literacy (TSL)

| Test | Average | N-Gain | Category |
|---|---|---|---|
| Pre-test | 62,75 | 0.74 | High |
| Post-test | 90,25 | | |

Based on the result, it can be seen that the findings revealed that the teaching with experiential learning model based on "Ketingan Tourism Village" has a high category on N-gain of science literacy. Students have a better to show scientific data and evidence, but it was less on doing investigation and explain the relationship content and phenomena. Science learning in accordance with the Nature of science allows students to gain knowledge through the inquiry process and will realize science literacy [26].

Teaching learning using experiential learning have several component namely concrete experiences requires full participation of individuals in the activity, while reflective observation requires individuals to develop various perspectives, abstract conceptualization requires attainment of the theoretical knowledge by the individual and active experimentation requires individuals to implement the knowledge [15]. In this study student participated to explore local potential Ketingan tourism Village by observe video and also direct observe. Thus, student can attainment abstract conceptualization of the theoretical knowledge about Interaction of Living Things and their Environment by explore and investigate resource Ketingan tourism Village to explain scientific phenomena. Show the evidence, and explain relationship between concept and its application, so it enhances science literacy.

## Effectiveness of Critical Thinking

Data of Test Critical Thinking (TCT) of knowledge and Observation Sheet on Critical Thinking (OCT) can be seen in Table 4 dan Table 5.

**TABLE 4**. Data of Test of Critical Thinking (TCT)

| Test | Average | N-Gain | Category |
|---|---|---|---|
| Pre-test | 74.3 | | |
| Post-Test | 84.2 | | |

**TABLE 5** Data of Observation Sheet of Critical Thinking (OSCT)

| Aspect | Score (%) | | | Average (%) |
|---|---|---|---|---|
| | 1st meet | 2nd meet | 3rd meet | |
| Interpretation | 68 | 82 | 89 | 79.7 |
| Analysis | 65 | 75 | 85 | 75 |

| Aspect | Score (%) | | | Average (%) |
|---|---|---|---|---|
| | 1st meet | 2nd meet | 3rd meet | |
| Inference | 67 | 86 | 89 | 80.7 |

It can be seen that the findings revealed that the teaching with experiential learning model based on "Ketingan Tourism Village" has a medium category on N-gain of TCT. Students have better to inference the phenomena and less on analysis it in science learning process.

Through potential-based learning “Ketingan tourism Village” students will make direct observations so that students can identify scientific questions, explain phenomena scientifically, and can make conclusions. Learning is directed at encouraging finding out from various sources of observation, not being told, being able to solve problems, train analytical thinking, work together, and collaborate in solving problems [12][27][28]. Student can interpret experience or phenomena that have been observe by direct observation or using learning video and also, they find the inference in it. After observe local potential, student analysis science concept in Ketingan tourism Village that related with Interaction of Living Things and their Environment theme. Therefore, it is important to teach science using an experiential learning that integrates local potential.

Cultural knowledge is not only about local wisdom, but abstract knowledge contained in the culture itself. The integration of local potential in learning will help students learn and gain potential around which is then sought to find out the scientific truth, so that students will build their own concepts [29]. The learning approach is carried out with an experiential learning, learning using an experience, students learn to organize and apply independently to find out the truth of knowledge about the community's original knowledge based on experience so that the concepts obtained are easy to remember [14][30][31]. However, it needs to improve analysis skill and how to investigated the phenomena based on local potential. Thus, further research needs to be done to develop complex investigative activities on local potentials so that they will improve students' investigative and analytical abilities towards the local potential.

## CONCLUSION

It can be concluded that learning that integrates local potential will create meaningful learning, embedded knowledge will become long-term memory, which will affect product cognitive knowledge so that it will create learning that is in accordance with the nature of science (NOS). It is meaningful to promote students critical thinking skills and scientific literacy to create appropriate learning based on the nature of science framework using local potential as a resource in the learning process.

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## REFERENCES

1. P.W. Hastuti, S. Nurohman, and W. Wibowo, J. Pendidik. Mat. Dan Sains **1**, 158-164 (2013).
2. A. Aditomo and E. Klieme, Int. J. Sci. Educ. **42**, 504-525 (2020).
3. S.R. and Y. Amalia Cahyarini, J. Pendidik. IPA Indones. **5** , 222-229 (2016).
4. D. Höttecke and D. Allchin, Sci. Educ. **104**, 641-666 (2020).
5. P.W. Hastuti, W. Setianingsih, and P. Anjarsari, J. Phys. Conf. Ser. **1440**, 012108 (2020).
6. M. Rutledge and K.C. Sadler, J. Coll. Sci. Teach. **41**, 38-43 (2011).
7. S. Rahayu, in AIP Conf. Proceedings (AIP Publishing, 2017), p. 020025.
8. R.C. Laugksch, Sci. Educ. **85**, 71-94 (2001).
9. R.A.Z. El Islami and P. Nuangchalerm, Int. J. Eval. Res. Educ. **9**, 261-268 (2020).
10. R. W. Bybee, "Scientific Inquiry and Nature of Science," In *Scientific inquiry and nature of science* (Springer, Dordrecht, 2006), pp. 1-14.
11. P. Häkkinen, S. Järvelä, K. Mäkitalo-siegl, A. Ahonen, P. Näykki, and T. Valtonen, Teach. Teach., **23**, 25-41 (2017).
12. C.N. Loes and E.T. Pascarella, J. Higher Educ. **88**, 726-753 (2017).
13. T. Nurita, P.W. Hastuti, and D.A.. Sari, J. Pendidik. IPA Indones. **6**, 341-345 (2017).

14. G. Mc Pherson-Geyser, R. de Villiers, and P. Kavai, Int. J. Instr. **13**, 877-894 (2020).
15. F. Alkan, J. Turkish Sci. Educ. **13**, 15-26 (2016).
16. A. Brailas, S.M. Avani, C. Gkini, M.A. Deilogkou, K. Koskinas, and G. Alexias, Qual. Rep. **22**, 271-288 (2017).
17. R. D. Handayani, I. Wilujeng, and Z.K. Prasetyo, Int. J. Learn. Divers. Identities **25**, 19 (2018).
18. R.D. Handayani, I. Wilujeng, Z.K. Prasetyo, and Triyanto, Int. J. Sci. Educ. **41**, 281-296 (2019).
19. P. Parmin and F. Fibriana, J. Penelit. Dan Pembelajaran IPA **5**, 142-154 (2019).
20. S. Sudarmin, M. Khusniati, N. F, S. A, and K. R, **247**, 413-418 (2018).
21. T. (SLO) Plomp and N. (SLO) Nieveen, Educ. Des. Res. 11-50 (2013).
22. F. Abd-El-Khalick, Sci. Educ. **22**, 2087-2107 (2013).
23. H.A. Yacoubian and R. Khishfe, Int. J. Sci. Educ. **40**, 796-807 (2018).
24. N.G. Lederman, J.S. Lederman, A. Nature, N.G. Lederman, J.S. Lederman, and A. Antink, Int. J. Educ. Math. , Sci. Technol. ( IJEMST ), **1**, 138-147 (2013).
25. P.W. Hastuti, W. Setianingsih, and E. Widodo, J. Phys. Conf. Ser. **1387**, 012059 (2019).
26. R. D. Handayani, I. Wilujeng, and Z.K. Prasetyo, J. Teach. Educ. Sustain. **20**, 74-88 (2018).
27. A. D. Saputro, S. Atun, I. Wilujeng, A. Ariyanto, and S. Arifin, Eur. J. Educ. Res. **9**, 765-773 (2020).
28. K. Changwong, A. Sukkamart, and B. Sisan, J. Int. Stud. **11**, 37-48 (2018).
29. C. A. Dewi, Y. Khery, and M. Erna, J. Pendidik. IPA Indones. **8**, 279-287 (2019).
30. C. J. Wenning, J. Phys. Tchr. Educ. Online **6**, 9-11 (2011).
31. E. Syaodih, A. Suhandi, A.R. Ningsih, N.J. Fratiwi, and A. Samsudin, Int. J. Sci. Technol. Res. **8**, 3734-3738 (2019).

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