The analysis of ethnoscience-based science literacy and character development using guided inquiry model

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Abstract. Building science literacy education in the 21st century began to be developed again especially in primary schools. The purpose of the research was to analyze of ethnoscience-carica based of science literacy and character development by using guided inquiry model. The place of research is at two state primary schools in Wonosobo Regency, Central Java. The mixed methods research was used, with embedded experimental model design. The subjects research are 56 students from primary school. Data collection was done by using test, observation, and documentation. The result showed the positive correlation between the mastery of science literacy an ethnoscience-carica based on the healthy food and students' character is $r = 0.58$ (medium); and gain factor $\Delta = 0.70$ (high). The conclusion of the research that the implementation of the guided inquiry model is to effective increase students' mastery of scientific literacy on the healthy food and students' character development.

1. Introduction

Science learning is applied to the process of education in schools using a scientific approach. At the level of basic education mandated scientific approaches, integrated thematic, and thematic in the learning process based on discovery and inquiry. This is consistent with the scientific learning research that the guided inquiry learning model directs students to be able to find knowledge through scientific work processes. The habit of scientific work is expected to foster the habit of thinking and acting to reflect the mastery of students' knowledge, skills and scientific attitudes [1].

Guided inquiry learning can effectively foster students' scientific attitudes through the application of science carried out by planning, experiments, research, observations, analyzing, and summarizing the results of data processing. This is in line with the opinion of the average score of students' scientific attitudes in science learning taught by the guided inquiry model is very high compared to other models [2].

Science literacy is knowledge and understanding of scientific concepts and processes needed for personal decision making, participation, and economic productivity [3]. This is similar according to the PISA (Program for International Student Assessment) which reveals that scientific literacy is the ability to use scientific knowledge, identify questions and to make conclusions based on evidence in order to understand in making decisions. According to the research showed scientific literacy really needs to be nurtured as early as possible because it is a fundamental ability that must be possessed by students [4].

The selection of textbooks and appropriate learning resources can increase the understanding of science and have an effect on increasing the mastery of scientific literacy [5]. Given the scientific
literacy is closely related to how a person can understand the environment and other problems faced by modern society that are very dependent on the development of science and technology, including social problems. Based on the depth of how to study science, expressed that science must be viewed from four dimensions, namely science is seen as a way to investigate, a way of thinking, a body of knowledge, and a product of interaction with technology and society [6].

Science achievements of students from Indonesia based on data on achievement of scientific literacy scores conducted by PISA 2015 are still below the average international score. Most participants who took part in the 2015 PISA test expressed high interest in the topic of science and acknowledged that science played an important role for them; but only a small number of participants reported that they participated in scientific activities [7]. Information on the results of scientific literacy tests obtained by Indonesian participants from PISA was 382 points in 2012 to 403 points in 2015.

The result of the study have shown the scientific literacy ability of Indonesian participants has increased from the previous year so it is necessary to instill positive values that encourage knowledge, awareness, willingness, and take action to be able to increase student scientific literacy to approach or even exceed international averages that are reached a score of 493. Although the scores achieved by Indonesian students are still below the average international score, students should be given positive encouragement and moral appreciation for being able to raise the score from the previous year. This impulse evokes positive character values in students to develop their potential.

The result of the character education is a growing discipline with deliberate efforts to optimize students' ethical behavior. The results of character education are always encouraging, sturdy, and continue to prepare future leaders [8]. This is in accordance with research that showed the implementation of character education through school pillars is based on three important reasons [9], namely: (1) the need for good character to be an integral part of human beings, every human being must have a strong mind, conscience, and a desire for quality such as having honesty, empathy, attention, self-discipline, perseverance and moral encouragement; (2) school is a good and conducive place to carry out the process of learning and education of values, and (3) character education is essential to building a moral society.

Referring to the result of the research of that there is an increase in student learning outcomes in learning science with the ethnoscience approach, because ethnoscience-based science learning brings students more interested, enthusiastic, and feel happy in a conducive learning situation [10,11]. The conducive learning conditions have been found, that students learn by using ethnoscience-based learning resources can build student character, especially the attitude of responsibility and care for the environment [12].

Ethnoscience encompasses the scope of community culture and regional production which includes the fields of food, textile, examples of batik and weaving, and skills products made from wood, metal, and soil. In this study discussed Carica plants that have been produced for decades. Carica plants or commonly called Dieng papaya or Dieng barren have the Latin name Carica pubescens or Carica candamarcensis. This plant is still a close relative of papaya (Carica papaya), but has its own characteristics. Carica plant life is relatively long, which can reach 15 years. Carica originates from southern Mexico and northern parts of South America. Currently Carica plants are widespread and widely planted in the tropics, including Indonesia.

There are two opinions regarding the classification of carica plants. Based on the classification by Smith and Hutchinson carica plants are distinguished in the sub-class classification and order. The classification of Carica plants based on the two opinions above is shown in Table 1.
Table 1. Classification of carica plants based on Smith and Hutchinson [13]

| Classification | Smith (1981)         | Hutchinson (1959)         |
|----------------|----------------------|---------------------------|
| Kingdom        | Plantae              | Plantae                   |
| Subkingdom     | Tracheobionta        | Tracheobionta             |
| Superdivisio   | Spermatophyta        | Spermatophyta             |
| Divisio        | Angiospermae         | Angiospermae              |
| Class          | Moncootyledonae      | Moncootyledonae           |
| Sub-class      | Dilleniidae          | Lignosae                  |
| Order          | Violales             | Cucurbitales              |
| Family         | Caricaceae           | Caricaceae                |
| Genus          | Carica               | Carica                    |
| Species        | Carica pubescens     | Carica pubescens          |

2. Methods

Mixed methods are used in research with embedded experimental designs. Embedded design is to submerge one method into another broader method, in a treatment. The research subjects were SDN X and SDN Y in Wonosobo Regency, Central Java Province. The choice of location was adjusted to the purpose of the research, which was to explain the implementation of ethnoscience-based guided inquiry learning to reveal students' literacy skills and character. In addition, consideration for raising local wisdom in Wonosobo is making carica candied (carica in syrup). Determination of research subjects using purposive sampling techniques with consideration of the same level of school accreditation, the school location from the carica craftsmen is quite easy to reach, and transportation using a minibus to the craftsman location is easy. Data collection instruments used were test question scripts, observation sheets, and interview guidelines.

3. Results and Discussion

The N-Gain Test is used to measure the increase between the pretest and posttest scores. The results of the N-Gain Test are presented in Table 2.

Table 2. N-Gain test results for students' literacy mastery

| Group      | Pretest (%) | Posttest (%) | N-Gain | Interpretation |
|------------|-------------|--------------|--------|----------------|
| Experimental | 63          | 90           | 0.70   | high           |
| Control    | 59          | 69           | 0.25   | low            |

Table 2 shows the scores for the experimental group after the ethnoscience-based guided inquiry applied with an average pretest score of 63 and posttest of 90 and the calculated N-gain of 0.70 (scale 0-1). The results of data processing obtained by the control group using the regular cooperative model averaged pretest scores of 59 and posttest of 69, and the results of the N-gain test were obtained 0.25 (scale 0-1). The results of the N-Gain factor analysis concluded that an increase in scores between the pretest and posttest scores was achieved in mastering students' scientific literacy. The increase in score can be categorized as low for the control group and high for the experimental group based on the N-Gain value. Illustration of increasing scores of both groups and N-Gain is presented in Figure 1.
Figure 1. Increased science literacy mastery score with n-gain (dark blue indicates the experiment group and light blue shows the control group)

Figure 1 shows there is an increase in mastery of scientific literacy obtained from pretest and posttest measurements. There was a significant increase in the experimental group, while for the control group an insignificant increase was obtained, including in the low category. The N-Gain Test is used to measure the increase scores in mastery of scientific literacy of healthy food material, for experimental group students after the implementation of ethnoscience guided inquiry models. The calculation results obtained show for the experimental group with an average pretest value of 63 and posttest of 90 and N-gain of 0.70 (scale 0-1) or 70 (scale 0-100) in the high category. From the N-Gain score it means that an increase in scores between the pre-posttest scores on the mastery of scientific literacy of students. The data of students’ character with scores was collected consist of the humanistic (2.3), social care (3.0), creative (1.8), and environmental care (2.3), in scale of 1-3. Protecting yourself and filling positive activities are explicit targets of education. The results of the study show that the best practice guides and self-moral descriptions are urgent needs and challenges in the field of education. Character education can play an important role in the construction of children and adolescents’ identity and can be a distinctive intervention for youth education and socialization. [14,15]. The research in line, show there is significantly a relationship between character education and critical thinking skills with sig. 2-tailed by 0.011 (<0.05) [16].

At the beginning of learning before applying the guided inquiry model based on ethnoscience, students’ mastery of scientific literacy is still low. Based on preliminary observations made by researchers during the learning process in the classroom, it was found that the scientific literacy of students was still low, at which time there were still many students who cheated on their classmates and were not timely in collecting assignments given by educators.

The results shown in Figure 1, the increase in mastery of scientific literacy data for experimental group was higher than control group after learning of ethnoscience-based guided inquiry models, 69 and 90. The difference in the value of scientific literacy mastery was because the experimental group was more active in seeking knowledge than the control group so it is better in concluding the knowledge gained. After comparing N-Gain values between the two groups of 0.25 and 0.70, it can be concluded the value increase of scientific literacy mastery obtained by experimental group is higher than control group.

The knowledge domain in research is measured using reasoned multiple-choice tests. The results of the analysis show that the knowledge sub-domain most dominated by students is to have an understanding related to the context, conduct an investigation to obtain evidence, and identify whether the conclusion is justified by the data. The students’ mastery of scientific literacy more clearly in the domain of knowledge. Students tend to be very good at memorizing but are less skilled at applying the knowledge they had, it is familiarized by the teacher [17].
Science literacy is an important provision for students to know readiness of students in order to face the challenges in society. Science literacy can be a benchmark for determining future student careers, whether students are involved in science [18]. This opinion is in accordance with that expressed by mastery of scientific literacy can be enhanced by practical learning by giving and guiding students to explore references, books as learning resources, and habituation of literacy education [19,20].

Base on the concluded, teaching materials in form of ethnoscience-based can improve student learning outcomes, because students become more active and gain direct and useful learning experiences [21]. The application of ethnoscience-based science materials is collaborated by the results of Atmojo's research which shows an increase in learning outcomes between students in learning with the ethnoscience approach and science literacy [22,23]. Experience the learning process directly is one of the principles of learning. Students learn on science literacy by experiencing it, including of environment themselves will get optimal learning results [24].

4. Conclusion
There is an increase in mastery of scientific literacy obtained from the pretest and posttest measurements. There was a significant increase in the experimental group, while for the control group an insignificant increase was obtained, including in the low category.

The N-Gain test is used to measure an increasing in mastery of scientific literacy of healthy food material of the pre-posttest scores of students after the implementation of ethnoscience guided inquiry models. Calculation result obtained show for the experimental group with an average pretest value of 63 and posttest of 90 and N-gain of 0.70 (scale 0-1) in high category. The results of data processing obtained by the control group using the regular cooperative model averaged pretest scores of 59 and posttest of 69, and the results of the N-gain test were obtained 0.25 in the low category (scale 0-1). The positive correlation between the mastery of science literacy an ethnoscience-carica based on the healthy food and students' character is \( r = 0.58 \) (medium) was found.

The research was concluded that the development of local wisdom-based science learning design to develop positive characters in schools that the implementation of science learning based on local wisdom not only enhances the positive character of students in schools but also increases student learning achievement.

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