Smoking fish in Banggi Village in learning of respiration system based on sustainable development

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Abstract. Sustainable Development in general is a human effort to improve the quality of life while trying not to go beyond the ecosystem that supports life. The smoking of fish in Banggi Village still creates smoke which can interfere with breathing for smoked fish craftsmen and the surrounding community. This study aims to determine the results of using fish smoking in Banggi village in learning the respiratory system to improve students' problem solving abilities. This study used sample of two classes. One class there were a number of students who received Sustainable Development based learning and one other class did not get this treatment. The research instrument was in the form of problem solving ability test items. The results N gain on problem solving abilities in the class with Sustainable Development based learning activities were moderate category, while the class with not Sustainable Development based learning activities were low category. The posttest scores of the two classes are obtained by Sig. (2-tailed) of 0.000 < 0.05. The conclusion of this study is that the use of smoking fish in Banggi village in learning the respiration system based on Sustainable Development can significantly (p<0.05) improve students' problem solving abilities.

1. Introduction
Country that is actively conducting development on various sectors both terms of education, economy, infrastructure, and other sectors, can will the positive impact addition to having positive impacts, there are also negative impacts on the environmental sector. Many fact, the condition of the environment in the past decade has worsened [1,2], so must be done in accordance with the understanding of Sustainable Development. Sustainable Development concept is a conscious and planned effort that integrates environmental, social and economic aspects into a development strategy to ensure environmental integrity and safety, the ability, welfare and quality of life of present and future generations. Sustainable Development that meets the needs of the current generation without compromising the ability of future generations to meets their own needs [3,4].

The concept of Sustainable Development is very important to be implemented on all community activities. For this reason, it is necessary to provide understanding to all people through education in schools [5]. One way through integration with materials in accordance with the curriculum in schools [6], is no exception material material in biology subjects.

There are many ways in integrating biological materials with the concept of Sustainable Development, namely by using real issues that exist in the daily lives of students, among others, local
culture, local wisdom, life style that is developing in society and so on. Furthermore, creatively and innovatively integrating the three aspects namely socio-cultural, economic, and environment to discuss issues learned by students so as to provide an understanding of knowledge, skills, attitudes and values relevant to their lives [7,8]. It will eventually be used to solve problems in the daily lives of students in the 21st century [9,10].

There are still many and important research problem solving abilities [11]. Problem solving skills can be developed through problems that occur in the environment around students [12]. The problems used can originate from cases (news), practicums and observations made [13]. Next, students are encouraged to recognize problems and find solutions. The process of finding a solution requires information both theoretically and empirically. The ability to solve of problems is deemed necessary for students to have, because this ability can help students to consider their thinking in various ways before making a decision. With the ability to solve problems, it is expected to develop students' ways of thinking or cognitive levels so that they can find solutions to problems encountered in daily life.

One of the issues / problems that can be studied by students in the Rembang area is the fish smoking process that pays little attention to sustainability. Based on the results of observations and interviews with the people of Banggi Village, information was obtained that the smoking of fish in Banggi Village, Rembang Regency was a long-standing economic source as a hereditary inheritance from his family. The process of smoking the fish is still done traditionally, it looks like it still uses simple equipment and does not pay much attention to aspects of health and environmental cleanliness, as shown in Figure 1.

![Figure 1. Smoke Sanitation is Not Managed Well in a Fish Smoking Activity in Banggi Village, Rembang Regency (Personal Documentation) ![Figure 1. Smoke Sanitation is Not Managed Well in a Fish Smoking Activity in Banggi Village, Rembang Regency (Personal Documentation)](image)

Human respiration system is an organ system found in the human body. These organs are used for oxygen uptake and removal of residual oxidation (reaction with oxygen) in the body in the form of carbon dioxide and water vapor [14]. The impact of environmental pollution that is very typical and can not be avoided, is the impact of smoke pollution [15]. Smoke pollution has a negative impact on the environment around fish smoke centers, including air and workers [16,17]. Intake of oxygen (gas) in the surrounding environment that has been mixed with smoke may be able to cause several disorders of the respiratory system such as allergy, asthma, and others [18].

A side from being a source of income for the surrounding community, the fish smoking activity has a negative impact, namely the presence of smoke and waste water which can creates odors that can interfere with health for workers and the surrounding community. The smoke and wastewater disrupt the respiration system of the surrounding community. Responding to this we need an improvement in the quality of the environment by carrying out proper environmental management. This requires understanding the concept of Sustainable Development.
Information was also obtained that the fumigation of fish in Banggi Village, Rembang Regency was considered as a source of pollution that was complained of by the community around the area. The activity of smoking fish is considered to have an impact on the declining quality of the environment due to the behavior of workers who do not think about sanitation of smoke and waste water. It is seen that the fogging equipment is not equipped with chimneys and sewerage due to the high cost of manufacture plus the workers are classified as having less knowledge.

Indonesia's human resource development must be treated as the center of Sustainable Development. So that the inculcation of the values of Sustainable Development in Indonesian people needs to be instilled and responded to in order to answer the challenges of the times, especially now that we are in the 21st century. At the same time development must be based on the efficiency and responsible use of the environment of all community resources with still pay attention to the economic and social side without exceeding ecological (environmental) functions.

On the basis of the above it is necessary to have thoughts and systematic steps to form the mindset of students in accordance with the concept of Sustainable Development. An alternative way to overcome this problem is to improve problem solving ability through learning respiration system material containing sustainability, therefore the purpose of this study is to determine the results of the use of fish fumigation in the village of Banggi in learning respiration systems based on Sustainable Development that are used to improve the ability student’ problem solving.

2. Method
This research is in SMA N 1 Lasem, Indonesia. The population in this study were students of class XI MIPA in SMA N 1 Lasem. Class XI MIPA consists of 5 classes. Samples taken from the population with certain consideration using two classes. Class XI MIPA 3 as an with activity Sustainable Development based learning and class XI MIPA 4 as a class not activity Sustainable Development based learning. The research instrument was in the form of items about problem solving ability test. In the problem solving test, student used the following heuristic: (1) identifying problems, (2) finding alternative solutions, (3) choosing the best alternative solutions, (4) testing the solution through empirical data collection (modifikasi from [19]). A problem-solving ability test is given to students before and after learning of the respiratory system.

Learning model in research using a model of problem based learning [20,21]. One class is supported by student activity sheets that contain with concepts in the respiration system following biology books from school. One another class using student activity sheet containing the teacher ingages students to explore fish smoking activities in the village of Banggi used aspects of Sustainable Development, namely economic, social-cultural and environmental concepts starting from formulating the problem, finding a solution until testing the solution using empirical facts related to the respiratory system.

Research data in the form of pretest and posttest problem solving ability. Statistical analysis used independent t test to see the significance of the pretest. The posttest analysis between the not Sustainable Development based learning and with Sustainable Development based learning groups used the Mann Whitney U test, and N gain to determine the increase in problem solving ability in the class with not Sustainable Development based learning and the class with Sustainable Development based learning. N gain criteria used are according to: $g < 0.3$ (low); $0.3 \leq g \leq 0.7$ (medium); $> 0.7$ (high). Statistical analysis consisted of homogeneity, normality, independent t test, Mann Whitney U test and N gain have use SPSS 21 software for the window operating system.

3. Result and Discussion
The improvement of problem solving ability before and after learning about Sustainable Development-based respiration systems using smoking fish in Banggi village is shown in Table 1.

| Test N Means and Standard Deviation Sign. |
|-------------------------------------------|
| Not Sustainable Development Sustainable Development |
| Table 1. Problem Solving Ability of Students |
Table 1 also shows the problem-solving abilities before and after learning of the respiratory system in the class with Sustainable Development based learning. Pretest value data were analyzed using the independent sample t test comparison technique to determine whether there were differences of in abilities problem solving of the class with Sustainable Development based learning and on the class with not Sustainable Development based learning. The results of the analysis note that the value of Sig. (2-tailed) of 0.236>0.05. This shows that the mean pretest scores of the two classes did not differ significantly (p>0.05). It can be said at the beginning of learning that both groups have the same initial ability.

After the learning ended the posttest scores of the with activity Sustainable Development based learning class and class the with Sustainable Development based learning activity were obtained, which are seen in Table 1. To find out whether there were differences in the ability of the two classes after being treated, an analysis was carried out using a comparison of the mean independent sample t tests. It is known that the posttest scores of the two classes were obtained by Sig. (2-tailed) of 0.004<0.05 indicates a significant difference in the two classes (p < 0.05). Furthermore necessary to analyze the achievement of the increase in the pretest to posttest using the N-gain test. The results of the N-gain test are shown in Table 2.

| Class                                | Pretest | Posttest | N-gain | Criteria |
|--------------------------------------|---------|----------|--------|----------|
| Not Sustainable Development Based Learning | 41,0 ± 9,89 | 70,9 ± 9,56 | 0,29 | Low      |
| Sustainable Development Based Learning | 40,9 ± 8,49 | 78,3 ± 7,46 | 0,63 | Medium   |

The data presented in Table 2 shows differences in two classes. The improvement of problem solving ability in the class with not Sustainable Development based learning is still in the low criteria while the class with Sustainable Development based learning has reached the medium criteria.

Based on t-independent analysis and N-gain shows that learning respiration system material containing sustainability has been able to improve the problem-solving ability of the with activity Sustainable Development based learning class. This is because in the class with Sustainable Development based learning used the context of smoking fish in Banggi Village provides a real picture so that it is easier to understand the problems that exist by observing the context than the class with not Sustainable Development based learning. That using real world problems (contextual) provides opportunities for students to be able to practice more in improving and developing their problem solving ability to be applied in everyday life [22].

Problem solving is the cognitive process of the brain that looks for solutions to a given problem or finds a way to achieve a given goal. When problem objects are identified, problem solving can be considered as a process of searching in memory space to find relationships between a set of solution goals and a series of alternative pathways [23]. In memory there is the association of responses, one of the laws of response is the law of causation or logical connection or having a logical connection with one another, arising together, associated and reproduced into consciousness. This can be seen in the summary of problem solving that has been done by students [24].

Problem solving activities using the issue of smoking fish in Banggi Village are carried out by stages of identify the problem, Find alternative solutions, Choosing alternative solutions (best), Testing the solution through empirical data collection. Improvement on stages of problem solving ability is presented in Table 3.
Table 3 shows that the percentage increase in the step of problem solving ability in the class with Sustainable Development based learning is higher than the class with not Sustainable Development based learning. This can be explained that in the respiratory system learning based Sustainable Development, student are trained to solve problems using these four stages. In detail based on the problem solving indicators, as follows: (1) The identification of the problem mentioned by students that fish smoke activity is a source of income and a source of nutrition for the community, but it is unfortunate every day that a lot of smoke is inhaled causing disruption and disease in the respiratory system for workers and the surrounding community, (2) Alternative solutions provided by students are making chimneys and using masks, (3) Alternative solutions chosen by students are that there must be chimneys because it can minimize air pollution and minimize respiration disorders for workers and surrounding communities, (4) Testing the solution through empirical data, identified and described by students that the smoke from smoking fish contains many chemical compounds such as formaldehyde, ketones, and tar in the form of particles and smoke. These substances enter the respiratory organs, namely starting from the nose, pharynx, larynx, trachea, bronchi, bronchial and alveolus through the mechanism of inspiration in the chest and abdominal breathing, then the chemical compounds in the smoke can settle in the tissues of respiratory organs causing disorders and diseases such as pharyngitis, bronchitis, emphysema of the lungs, asphyxiation and lung cancer. With a chimney can reduce exposure by 10-20% than by using open fire.

Based on students' heuristic data of problem solving ability can be seen that students can find alternative solutions to problems arising from smoking fish process. The results of the summary of problem solving that have been done by students in the class with activity Sustainable Development based learning have shown that economic activities, namely smoking of fish as a source of income and nutrition of the community must be managed properly that is using chimneys so that it does not cause air pollution that can cause interference and illness for workers and society around.

The smoking fish context is used to bridge the students' problem solving abilities. The concept of Sustainable Development explored in smoking fish activities in Banggi village by students can help students solve problems by making appropriate, careful, systematic, logical decisions, and considering various perspectives, namely economic, socio-cultural and environmental. That "sustainable" has the potential to develop students' skills and motivation to find more innovative and creative solutions to deal with business, social and environmental problems [25].

Another opinion that smoking fish activities are contextual and authentic problems with the daily lives of students. Contextual problems can be used to improve problem solving ability in students [26,27,28,29]. Many authentic problems are defined as ill-structured problems, are problems that not only have one kind of solution, problems involving various disciplines / studies, and also problems, which provoke thought to find alternative formulations and solutions. Authentic problems are also interpreted by familiar problems, known to students, that occur around the school or residence of students, and / or problems that are being raised.

Based on the 17 sustainable development goals, a learning the respiration system with sustainability using the smoking fish in Banggi village can support several goals [30], including namely good health and decent work (social perspective), well being and economic growth (economic perspective) and life on land (environment perspective).

4. Conclusion
Based on the results of research that has been done it can be concluded that the use of smoking fish in Banggi village, Rembang district in learning respiration systems containing sustainability can be used
to improve students' problem solving abilities. The t-test results that there is a significant difference between the posttest value of the problem solving abilities of the class with Sustainable Development based learning and the class with not Sustainable Development based learning. An increase in the pretest to posttest value of problem solving ability in the class with activity Sustainable Development based learning was achieved with a N gain of 0.63 (medium category). Sustainability-based learning is a contribution to realizing Sustainable Development, namely the goals of good health and well being (social perspective), decent work and economic growth (economic perspective) and life on land (environment perspective).

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