Application of Integrated STEM-Based Student Worksheet Local Potential of Pagar Alam Tea Plantation to Improve Students' Environmental Literacy

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Abstract: This study aims to analyze the environmental literacy of students with the application of STEM-based Student Worksheet Integrated Local Potential of Pagar Alam Tea Plantation ecosystem material. This research was carried out at SMPN 06 Pagar Alam. The time of the research was carried out in October-November in the odd semester of 2021/2022 in class VII. The type of research used is descriptive analysis. The sampling technique used is purposive sampling. The number of samples used in this study were students of class VII C totaling 30 students. The data collection technique consisted of interviews, observations and tests. The results of environmental literacy students' average percentage of environmental literacy achievement scores scored 42 with a good enough category so that the use of integrated STEM Student Worksheet Local Potential was able to train environmental literacy skills well. Suggestions for further researchers are to prepare the maximum time for this learning, because at the time of this research yesterday the researchers only had a little time so that the results of the learning had not been carried out properly.

Keywords: Environmental literacy; Student worksheet; STEM; Local potential

Introduction

Advances in information and communication technology as well as challenges in the future are marked by a new era, namely the era of the industrial revolution 4.0. This era of information technology revolution has become the basis of human life (Kemristekdikti, 2018a). The era of the industrial revolution 4.0 also has an impact on the world of education, especially in science education, namely changes in educational patterns and goals, in science learning it focuses on using technology to meet future needs. According to Singgih, (2020) Science education has a role in producing human resources who are creative, innovative, and have superior abilities, both soft skills and hard skills, so they can face various global

issues. The skills that need to be taught by students in this revolutionary era are 21st century skills, so that students can face the challenges of the 21st century, these skills have four types of skills which are often known as "The 4Cs" Communication, collaboration, critical thinking and creativity (Haryanti, 2018). The skill that needs to be developed in the 21st century is environmental literacy. Concern for the environment is very basic to prevent damage to nature, especially those caused by humans (Subhan, 2017).

The results of PISA 2006 put Indonesia in 52nd place (lowest 6th rank) for both environmental science and geoscience from 57 countries held (OECD, 2009). The results of the study (Igbokwe, 2016) stated that the environmental literacy of students was only 29.3% who did not meet the environmental literacy assessment

standards. The results of the study (Pujianti, 2018) stated that environmental literacy for the skill aspect was still relatively low at 14.71. Putriana et al., (2020) stated that junior high school students showed that out of 95 people, only 29 students (30.52%) could solve environmental problems in the form of forest and land fires, in addition 43.87% of 98 students were able to analyze issues local environment (Suzanti et al., 2019). Ilhami Research (2019) The average environmental literacy of students at Pandam Gadang Middle School, West Sumatra, is 69%, this shows that environmental literacy is at a moderate level.

One of the efforts that can be done to preserve the environment is through environmental education. Based on the regulation of the Minister of the Environment Number 05 of 2013, the Adiwiyata program aims to create schools that care and are environmentally cultured. For junior high school education, the material for environmental pollution is contained in Basic Competence 3.8, namely Analyzing the occurrence of environmental pollution and its impact on the ecosystem (Kemendikbud, 2013). Educators need a learning strategy process so that students have good competence to solve a problem in everyday life. One of the science learning themes in junior high schools that is adapted to the needs of technological developments is the Local Potential Theme which is integrated into the STEM field.

STEM "Science, Technology, Engineering, and Mathematics is one of the learning methods that can train students in applying their knowledge to design and solve a problem related to the environment through the use of technology. STEM education, which provides the integration of disciplines of science, technology, engineering, and mathematics is an innovative approach and support the upbringing of science and technology literate individuals (Erdogan,I & Ciftci,A. 2017).

STEM is an alternative approach, because the STEM approach gives educators the opportunity to show students the concepts, principles, and technical sciences, engineering technology and mathematics used in an integrated manner in the development of products, processes, and systems used in everyday life. The implementation of STEM-based science education changes learning from conventional teacher-centered learning to student-centered learning towards more collaborative learning and emphasizes the application of scientific knowledge, creativity and problem solving (Rustaman, 2016). Teacher mastery of knowledge can increase STEM self-efficacy for pre-service science teachers (Putra et al, 2021). The STEM approach is associated with the environment, manifesting a learning that presents the real world experienced by students in everyday life (Herak et al, 2019). STEM-based science learning can be combined with one of the learning tools, namely the Student Worksheet.

STEM-based student worksheets received good responses from students and can be used in the learning process (Aristo & Togi, 2019). The implementation of the PBL learning model combined with STEM-based student worksheets improves students' critical thinking skills (Hasanah et al, 2021). The application of PBL combined with E-STEM-based worksheets on the cognitive learning outcomes of students, indicators of remembering, is able to improve student learning outcomes (Amalya et al, 2021).

STEM-based student worksheets can also be integrated with local potential to support science learning, this is in accordance with the Ministry of Education and Culture No. 81 A of 2013 which states that local potential is a study material for the uniqueness of the local area used to shape students' understanding, knowledge and skills. Based on the results of research (Dewi et al., 2017) in class VIII of SMP, local potential-based learning can improve students' critical thinking skills because students can interact directly with the surrounding environment and get a positive response of 94.44%.

According to Kahar et al (2018), local potential is a resource that exists in a certain area that develops from the tradition of local wisdom owned by humble communities as part of their culture. Local potential has meaning as a resource owned by each region to be utilized, one of which is in the field of education. Pagar Alam is an area that has a lot of potential for high diversity of plant and animal species, this is supported by a mountainous ecosystem that still has natural rain forests and its beauty is still maintained (Iswanto et al., 2016). Tea plantations are one of the results of local potential in the city of Pagar Alam.

The high diversity of plant and animal species in this area is generally dominated by the "lower community". Lower community is a term used by a group of animals and plants that are in an ecosystem type. The lack of exploitation in this community is also due to the existence of a community that is closed from the canopy of tea plants which are widespread in the tea plantation area. Tea plantations are an ecosystem located at an altitude above 800 mdpl with a canopy cover of up to 85% (Pratama et al., 2013).

The local potential of natural fence tea plantations can be used as learning content for students, namely on Ecosystem material where students can identify between ecosystem components and can also interact directly with living things in their environment. Therefore, learning tools will determine how the process and learning outcomes of students are in accordance with the educational curriculum.

The results of the research conducted (Hasan et al., 2016) at SMP N 06 Bibinoi explained that the learning outcomes on the material determining the ecosystem and the relationship between the components of the

ecosystem, the results of the minimum criteria completion were still relatively low, the students who took the test had not yet achieved the minimum criteria completeness scores, the results of the mastery results were the average is 25%. The incompleteness of the material studied, because the material studied requires in-depth understanding so that students are able to determine the ecosystem and the relationship between ecosystem components. Cooperative learning approach with the Student Teams Achievement Division model is recommended in science learning. Generally, science learning is still dominated by teacher activities. The class only focuses on the teacher as the main source of knowledge and is only guided by textbooks. Learning activities do not provide opportunities for students to interact with concrete objects in real situations.

Based on the above background, it is necessary to change a learning process to achieve the goals of National Education. Based on the problems described, it is necessary to apply the Local Potential Integrated STEM-based Student Worksheet to improve the Environmental Literacy of Students. This study aims to motivate students to learn and develop skills according to local potential. The local resources of the natural fence tea plantation can be used as a source for learning about how to use and conserve them.

Method

This research was conducted at SMPN 06 Pagar Alam. The time of the research was carried out in November in the odd semester of 2021/2022 in class VII. The type of research used is descriptive analysis. The sampling technique used is purposive sampling. The number of samples used in this study were students of class VII C totaling 30 students. Data collection techniques consist of interviews, observations and tests.

This research was conducted face to face. The research process begins with interviews with teachers, observations of the school and the school environment, learning observations, making products and instruments, implementing and processing data. The instrument used has been validated by the validator. Interviews with teachers aim to determine the applied learning, to determine the characteristics of students, students' academics and the learning resources used. Observations of the school and in the environment around the school were carried out aiming to find materials in the manufacture of products, namely the STEM student worksheets integrated with the local potential of tea plantations. The instrument consists of 10 multiple choice questions about environmental literacy. The determination of categories is based on the equations contained in Table 1 (Mardapi, 2012)

Table 1. Basis of value categorization

Average Range	Score	Category
$X > (\overline{Xi} + 1.50 SBi)$	A	Very Good
$(\overline{Xi} + 1.50 SBi) \geq X > \overline{Xi}$	B	Good
$\overline{Xi} \geq X > (\overline{Xi} - 1.50 SBi)$	C	Enough
$(\overline{Xi} - 1.50\,SBi) \geq X$	D	Not good

Information:

X = The average value obtained

$\overline{Xi}$ = ideal average = ½ (max score + minimum score)

Sbi = ideal standard deviation = 1/6 (max score – minimum score)

Result and Discussion

The use of local potential-based media is proven to increase students' understanding of concepts and environmental care attitudes of students. The local potential of an area needs to be developed because it is a characteristic possessed by the area. The natural fence tea plantation area is one of the local potentials of the natural fence so that it is still preserved and becomes a natural resource for the natural fence community. Students are part of the local community so they are expected to understand the local potential around them and can make the natural fence tea plantation a learning resource.

Learning resources provided by students are STEM student worksheets with the Local Potential of Pagar Alam Tea Plantation. The steps of the learning process are with the guidance of a learning program plan where in the first stage students are given a stimulus regarding the local potential of natural fence plantations associated with ecosystem material, then in the second stage students are divided into groups and distributed student worksheets, each group conducts discussions starting from identify learning objectives, then read tools and materials, identify how they work, identify a picture of the components of the natural fence tea plantation ecosystem and enter observation table data.

The last stage is that students are given multiple choice questions to measure students' environmental literacy. This stage is the evaluation stage of student learning where students are given 10 multiple choice questions on ecosystem material. The result is that the average value indicator aspect and category of each aspect is calculated in Table 2.

Environmental literacy is very appropriate if it is integrated in the 2013 curriculum which focuses on character and competence. Environmental literacy ability has four components, namely environmental knowledge which includes the basics of the environment, attitudes towards the environment

which include views about the environment, sensitivity to the environment, and feelings towards the environment. Cognitive skills which include identification of environmental problems, environmental analysis and implementation of planning; as well as behavior that includes concrete actions towards the environment. This component has included the assessment of student learning outcomes in the 2012 curriculum which includes cognitive, affective and psychomotor (Kusumaningrum, 2018). Based on the results of the analysis of the four aspects of the average percentage value of environmental literacy achievement using the Integrated STEM-based Student Worksheet on the Local Potential of Pagar Alam, it is known that the environmental literacy of students has an average of 42% with a good enough category.

Table 2. Environmental Literacy Results

Aspect	Average Percentage of Achievement (%)	Category
Know the basic concepts of environmental literacy	48.89	Enough
Identify environmental literacy knowledge	13.33	Not Good
Solving environmental literacy problems	20.00	Not Good
Identify environmental issues	93.33	Very Good
Average	42.00	Enough

The first aspect has an average value of 48.89 in the good category. In this aspect, students are able to know the basic concepts of environmental literacy presented in the evaluation of ecosystem material. Where students analyze the components of an ecosystem component.

The second aspect of identifying environmental literacy knowledge has an average value of 13.33 with a very poor category. In this aspect, there are still many students who have not been able to identify a problem on their own, they are used to identifying problems with the teacher. This is in accordance with research (Sinaga, 2018) which emphasizes that science learning should be more emphasized on providing contextual environmental issues or problems to develop students' competencies to be able to explore and understand the natural environment around them scientifically and be directed to find and do, so that it can help students to gain a deeper understanding of the surrounding environment.

The third aspect of solving environmental literacy problems is the score of 20.00 is very poor where students are not used to working on evaluation questions about environmental literacy, students are still often accustomed to working on questions fixated on books. The increase in students' environmental literacy

is not too significant because there are several factors that influence it, namely because of the low knowledge of students about environmental literacy. Learning in schools also affects the level of environmental literacy possessed by students as stated by Stoller-Patterson (2012) is a process in which a person's environment is intentionally managed to allow him to participate in certain behaviors under special conditions to produce certain responses, Learning is something that is most special in the world of education.

The fourth aspect identifies environmental issues with an average score of 93.33 with a very good category. This aspect has a score percentage in the very good category because students identify literacy on environmental issues by being directly linked to the local potential of the Pagarlam Tea Plantation so that students are easy to identify real environmental issues that exist in everyday life. This is also in accordance with research (Teksoz et al., 2010) that classroom activities centered on direct experience of environmental issues provide opportunities for students to understand several experiences to increase their awareness of a better and healthier environment.

Learning science with local wisdom can help students strengthen the science concepts obtained so that students' environmental literacy skills increase (Ilhami, 2019). Learning using the Natural Science Student Worksheet website integrated with the peatland environment with the theme raised in the Science Student Worksheet website can motivate students about awareness of the surrounding environment and improve students' environmental literacy (Hekmah et al, 2019).

Conclusion

Based on the results of this study, it can be concluded that the application of the Integrated STEM Student Worksheet on the Local Potential of Pagar Alam Tea Plantation can improve environmental literacy skills with an average percentage value of 42 achievement in the Fairly Good category. The results of the research can be used as suggestions and references for researchers or educators in the implementation of science learning in order to make maximum use of the local potential that exists in their respective areas. This can provide more meaningful science learning because it is closely related to the daily lives of students. Suggestions for further researchers are to prepare the maximum time for this learning, so that learning with the integrated STEM method of local potential can be carried out properly and meaningfully.

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