

LOW CARBON EDUCATION: STUDENT'S UNDERSTANDING, APPLICATIONS IN DAILY LIFE, AND SCIENCE LEARNING

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Abstract

The purpose of this research is to investigate students' understanding and application of low carbon education (LCE) in their daily life especially when they learn environmental learning. This research used a survey method to the 453 students from elementary school and junior high school who has already studied environmental education in Bogor. The instrument that is used is 34 questions included in the questionnaire about LCE comprehension, implementation in classes, and implementation of environmental education. The results described that most of the students did not know about LCE terms, they understand and already done about environmental education and all the activities such as shorting trash as organic and inorganic, not litter due to clean river and ocean, eating nutritious food rather than junk food, plant trees to make the environment is beautiful and shady, use public transportation rather than the private car, and use goody bag rather than plastic. But the term and explanations about carbon emissions, still feel strange about those terms. It concluded that students have already done the activity about environmental saving, they have already literate about the environment, but not focused on carbon emission and LCE. Those terms need to be developed in environmental learning at school and especially at university because they will become a teacher and apply their knowledge, skills, and attitude in school as a teacher.

Keywords: Daily life, Low carbon education (LCE), Science learning, Students' understanding,.

1. Introduction

Climate change is currently the biggest issue besides the Covid-19 pandemic which is included in the agenda of world leaders and institutions to deal with this, including Indonesia [1-4]. The human population, technology, or machines continues to grow, be created, and be used in almost human activities. It also causes damage to the environment as a result of the consumption of food, natural materials, and energy, especially non-renewable ones, it makes greenhouse gas emissions into the atmosphere and causes increasing the earth's temperature globally and climate change [5].

The majority of problems afflicting the environment must be related to the lifestyle and activities of the community [6]. Fossil energy consumption for various human needs is the largest contributor to greenhouse gases in the atmosphere, causing global warming and climate change (e.g., CO₂, CH₄, O₃, and NO_x) [7, 8], and the largest to date is CO₂. Globally, the average earth's surface temperature increase in 140 years was 0.85°C and sea levels rose as high as 225 mm, and the global concentration of carbon dioxide gas is currently the highest in 800,000 [6] [9]. The amount of CO₂ emissions is crucial in determining the quality of the environment [10]. This context is global warming and climate change.

Reflecting on the current environmental damage, building public awareness and concern for the importance of protecting the environment and maintaining environmental sustainability is something important and must be done immediately. Building the mindset and awareness of the community, including students, is the first and foremost way to overcome this situation and attract them to contribute to environmental protection efforts [11, 12]. Teaching about materials, issues, problems, and environmental challenges is very important to do, especially in the educational process [13]. Education for sustainable development has been declared [14], where education for sustainability is an integral part of achieving SDGs quality in education [15]. This is eager to build the commitment of all countries to develop education that contributes to sustainable development.

Global warming and climate change, which are the main global environmental problems today, require the education sector to pay more attention to reducing carbon emissions [16]. It is called low carbon education (LCE). Education today must be transformed or at least integrated with LCE as a form of contribution to realizing low carbon development and sustainable development. LCE is an educational pattern designed to create a CO₂ emission-friendly society or a low carbon society integrated into science or environmental learning. Some research has already been done to discuss deeply in several countries such as China and Malaysia which have already implemented LCE [17], but in Indonesia, the term low carbon itself is still rare and few researchers have conducted that research. Thus, the purpose of this study is to investigate the understanding and application of LCE to students in schools, especially at the basic level, i.e., elementary and junior high schools. This research is preliminary. It is conducted to achieve the goals of the SDGs through education.

2. Low Carbon Education

Especially in Indonesia, the data in Fig. 1 explains about the amount of carbon emission gas of CO₂ increased annually over two decades. This encourages the

current widespread impact of climate change caused by greenhouse gases, making glaciers melt, rising sea levels along with worsening pollution levels, floods, landslides, and drought. The people have to face it and deal with it. Climate change begins to rise as the biggest challenge to the development agenda and policy. This has moved developed and developing countries to reduce the rate of carbon emissions by implementing the program regarding SDGs, one of which is low carbon development [18, 19]. LCE is a teaching pattern based on energy saving, low energy consumption, and low energy awareness [20]. The aim of LCE from Fig. 2 is to provide actual situations in school education to solve various problems based on increasing gas emissions by using knowledge of science and technology from the point of view of everyday life to achieve a low carbon society in school education and families.

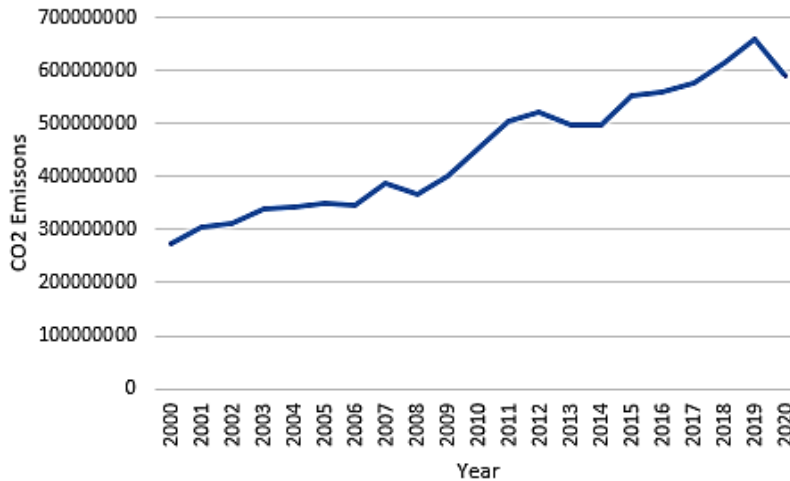


Fig. 1. Indonesia annual emission gas CO₂ from 2000-2020.

3.Method

We used a qualitative survey of 453 students. 177 elementary students and 157 junior high school students are from Bogor, Indonesia. We used is 34 questions included in the questionnaire about LCE comprehension and implementation of environmental education in science classes. This research is conducted for about one month collecting the data from participants. Before the questionnaire is disseminated to the participant, it is validated by three experts in LCE and education sustainable development. The other instrument besides the questionnaire, there was an interview with the teachers and students about the implementation of environmental learning related to LCE in classes. The questions in the instrument are developed based on the research questions, there are 1) How is students' perception or understanding of LCE? 2) How is the LCE emerging in daily life and science learning? Data analysis is done by descriptive analysis. The data from the questionnaire are proceeded by simple statistic calculating based on the mean and percentages from the respondent's answers. The data is delivered by the bar chart.

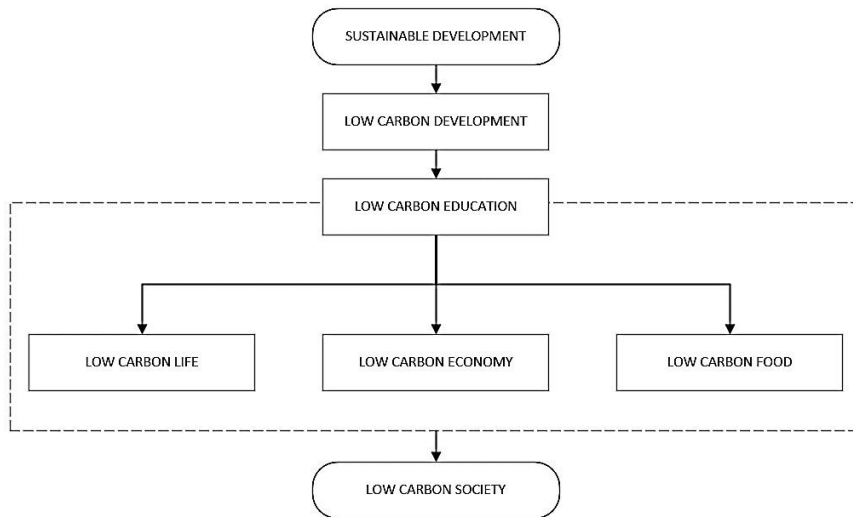


Fig. 2. LCE framework

4. Results and Discussion

Figure 3 describes the results related to the student's understanding of LCE. Approximately 68% of students have not understood about LCE concept and its meaning. The students also have not received and read about LCE in the classroom. 32% of students admit they knew about the LCE concept and its meaning. They thought LCE is an abbreviation of “low carbon education” and it is all about pollution, especially air pollution. They relate it with gas emissions from the vehicle, residue gas emissions from industrial activity that evaporates in the air and then makes dirty air, an unhealthy environment, and even makes climate change, and ozone damage.

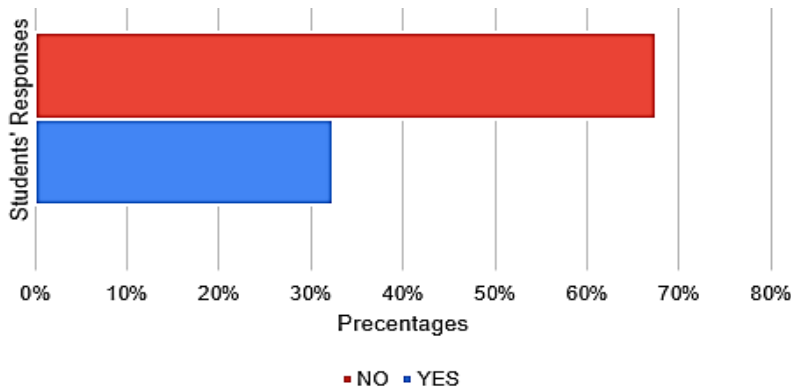


Fig. 3. Students' understanding pertaining LCE

Those research results are in a line with the research that has been done as most of society still have to lack an understanding of the low carbon concept and its meaning especially its application in daily life [21]. It is strengthening LCE that has not been applied in Indonesian curricula. The data is taken from students in

every grade and level in Bogor, 67% of elementary students and 68% of junior high school students never heard or received the specific low carbon concept in their learning in the classroom either in science learning or environmental learning. Whereas, many topics or material in science that is directly related to the aspect of sustainability of life, such as energy, combustion and greenhouse gases, photosynthesis, and cycle material [15]. Environmental teaching practice running so far, figure out the topics of LCE as education with minimal carbon emissions is only a small fragment of the environmental education system in Indonesia [22]. LCE topics and applications are implicitly taught in environmental learning in the classroom. For instance, greenhouse effect, fossil fuel, air pollution, renewable energy, waste management, water management, etc. Material about energy, greenhouse gases, CO₂ emissions, to climate change is the core substance of LCE [23]. Environmental education is taught not in the form of separate subjects, but the form of a unit with certain subjects and fields of study through an integrated approach. It is implicit while delivered to the students. Thus, students have their understanding of small fragments of the LCE concept, but they rare to hear about LCE's meaning and terms. Figure 4 explains students' LCE activity have implemented at school in general.

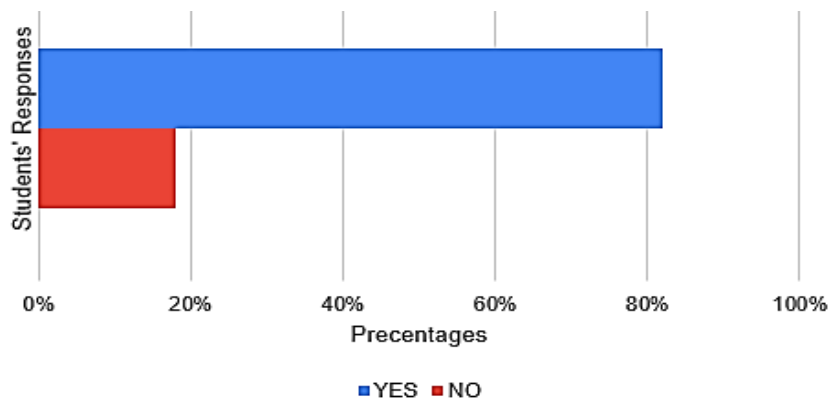


Fig. 4. Implementation of LCE in the classroom

85% of elementary students and 80% of junior high school student's activities represent LCE topics and concepts. The activity is shorting trash as organic and inorganic, not litter due to clean rivers and oceans, eating nutritious food rather than junk food, and planting trees. The environment becomes beautiful and shady, use public transportation rather than the private car, and use goody bags rather than plastic. All those activities figure the concept of low carbon in daily life tends to make a minimum production of CO₂ as gas emissions. From the data, students have already reduced several CO₂ as gas emissions. The notion of LCE concept has been applied in their daily life without them knowing. Those activity has already been done by the students either in the school which applied for the green school program or does not apply. The advantages of a school that has applied for a green school program, their activities are more organized and well prepared for budgeting. For instance, there is a trash bank that collects the trash from students which have been separated organic and inorganic by the bin, treats waste, and recycles. Proceed used cooking oil become fuel. The students also bring their lunch using their cutlery and the canteen prohibited to use of Styrofoam and plastic as cutlery. Several reports

prove that eco-schools or green school program has a positive effect on the students' understanding of values and the application of environmental values, even though it has not affected their behavior yet [24-26].

The activity of LCE concept has been taught indirectly or integrated with environmental learning or science learning must continue and be applied in the student's daily life [27-29]. The final purpose of LCE is low carbon society, i.e. understand, apply, and have an attitude toward the low carbon concept which reduces gas emission due to make climate balance in the world and reach sustainable development goals. Building awareness and care for society on the importance of protecting the environment and maintaining environmental sustainability is something that is important and must be done immediately [29-33]. Building the mindset and awareness of the community, including students, is the way first and foremost to overcome this situation and attract them to come along and contribute to environmental protection [9]. This process should be done as early as possible and applied at all levels of education from elementary, secondary, and higher education [34, 35].

5. Conclusion

Most students still lack an understanding of LCE concepts, terms, and meaning. They have not heard about LCE terms in their classroom or curricula. Thus, students have already done the activity of low carbon concept in their daily life, such as shorting trash as organic and inorganic, not litter due to clean rivers and ocean, eating nutritious food rather than junk food, planting trees to make the environment is beautiful and shady, use public transportation rather than the private car, and use goody bag rather than plastic. They learn about LCE concepts through environmental learning and science subjects. When students have already done the activity about environmental saving, they have already learned about the environment, but not focused on carbon emission and LCE.

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