Strengthen the student environmental literacy through education with low carbon education teaching materials

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Abstract. Science education should be able to make the students better understand and be sensitive to the environment. Nowadays, earth is affected by the greenhouse effect and global warming, which is caused by greenhouse gas emissions, especially CO2. Instructing the awareness and sensitivity (environmental literacy) about the environment is very important to do. Education is the best way to grow and develop environmental literacy among the younger generation. The educational component that is very easy to be used as a means is a teaching material in the form of low carbon teaching materials. This study aims to provide a formulation of the social context associated with a reduction in CO2 emissions and its scientific explanation, as well as describe the pattern of presentation of these substances in the teaching materials. Low carbon teaching materials become a vehicle that raises the whole substance relating to CO2 emission reduction efforts. Substance in these materials taken from the contexts of everyday life, for example the CO2 emissions of various types of lamp, CO2 emissions in the type of fuel, CO2 emissions in the type of energy (LPG-LNG-Biogas), until the CO2 emissions from cigarette that burned. These contexts are given its scientific explanation (including calculations) but are presented in a simple-structured in the low carbon materials thus substantially easier to grasp. The presentation is also accompanied by analysis, stimulation of high order thinking skills, activities, and personal-contextual analysis.

1. Introduction
Globalization and industrialization beside producing progress for our nation, also bring negative impact on the ecosystem (environment). In general, Environment can define as an entity that covers the entire object space, power, state, and living creatures, including humans and their behaviour, which mutually affect one another. The environmental damage will reduce the quality of life and threatens the sustainability human in nature. Environmental problems occur due to the inability of humans to develop a system of social values that are environmentally friendly and lifestyle in harmony with nature. Global warming and climate change are happening now is a result of the misalignment caused by high levels of greenhouse gas emissions as a consequence of which accompany the progress of industry and technology. The lifestyle that a lot rests on the technology also spur an increase in the concentration of greenhouse gases in the atmosphere as a result of consumption of high energy, particularly electricity. This much is not understood and realized by most people.

Global warming defined as an event increasing the average temperature of the earth's upper atmosphere and surface. IPCC (Intergovernmental Panel on Climate Change) in 2008 concluded that...
most of the increase in global average temperatures since the mid-20th century, most likely caused by increased concentration of greenhouse gases due to human activities [1]. Globally, the average increase in temperature of the earth’s surface in 140 years at 0.85°C and sea levels rise as high as 225 mm, and the concentration of carbon dioxide gas globally are the highest in 800,000 years [2]. The effects of misalignment that already we are currently facing. The impact is most felt and easily detected is rising sea levels resulting in a shifting coastline and island boundaries, increasing the potential disasters such as hurricanes, sea storms, extreme waves and beach erosion [3]. Weather anomalies until the extinction of living species have also been a result of global warming and climate change.

The engine of globalization now is moving with technology that greedy in energy consumption and abundant pollution (emissions). This reality must be responded to hasten efforts to enhance awareness of and concern for the environment, especially in the younger generation to prevent severe environmental damage in the future. Education is the most appropriate means to facilitate the investment process and the development of environmental literacy in the younger generation. Integrated environmental education in science education should be able to build awareness and develop emissions-friendly behaviour, in other words, low emission level (low carbon education) should be the main emphasis in teaching students about science and the environment. Materials or issues raised in the implementation of science education/environment must be created diverse, contextual, and interdisciplinary. Emphasis is important to teach environmental literacy to the public is to intervene through their reading materials or literature [4]. The younger generation is still in the process of education, of course, must have reading materials that promote their ratio to be digested using the logic of thinking that is emerging. So, expect the understanding that they get will indeed emerge from the work of thinking material surely must have reading materials that promote their ratio to be digested using the logic of thinking that is emerging. So, expect the understanding that they get will indeed emerge from their thinking process. Low carbon reading materials designed to promote thinking skills especially evaluative thinking into understanding the low carbon material substance that want to be conveyed. Thus, the development of environmental literacy especially low carbon literacy among the young generation becomes more easy, effective, and faster. The question in this study that is how the pattern of development and forms of teaching materials of low carbon good education to develop the environmental literacy of the young generation?

2. Methods
In this qualitative study the authors tried to develop a formula for preparing and presenting the substance of low carbon in public life to be given a scientific explanation and constructed into a science teaching material. In this case, the author uses a literature study. The process in this study is carried out through a review of the book, literature, and scientific articles on environmental education, low carbon environmental education and literacy. Data and findings from various research and a literature review of data in this study. Then the data will analyzed and synthesized become a framework structured scientific information.

3. Result and Discussion
3.1. Environmental Education and Low Carbon Education A subsection
The environment simply could be understood as a system of life which is the unity of biotic and abiotic components that interact in the same space. But entering the era of Industrial Revolution 4.0 today, the greatest threat to our lives today is sustainability. This is due to the reduced carrying capacity of nature to life, it is caused by the inability of humans to develop a system of social values that are environmentally friendly, as well as their lifestyle is not in harmony with the environment. As a result, natural systems going broken and the balance of the ecosystem becomes disrupted, which in turn threatens the sustainability of life on earth creature. On the other hand, modern lifestyle further alienates the public from environmental values.

Education should be the guard in front of efforts to regrow public awareness and environmental literacy. Environmental education is expected to educate the public and encourage young people to
behave more concerned about the environment. Goldman, Pe'er, and Yavetz [5] reveal that education is the most important component to creating a society that has a good environmental literacy.

The environmental education is a process that includes five key elements, namely: awareness, knowledge, attitudes, skills, and action or participation. In school, it cannot be taught separately from one another, because basically, it is an interdisciplinary study taught through multiple subjects [6]. In general, there are several ways to teach environmental literacy and implement environmental education is a formal way as eco-school, informal collaboration with the family, and non-formal nature exploration, or through a course template. Environmental education formally applied to the students in the world of schooling and curriculum, so this way seemed stiff and theoretical. Pauw and Petegem [7] examine the eco-school education, they found that the eco-schools have a positive effect on the understanding of the value and application of environmental values on students, although it is not yet up to affect their behaviour. While Tali Tal and Anat Abramovitch [8], in his research managed to identify at least three main activities that can be applied in environmental education in schools: (1) sharing knowledge with other students or prepare leaflets about the environment. (2) improving the quality of the school environment clean, create school gardens, repairing garden, or make the recycling of waste. (3) social actions such as cleaning the beach, educationnon-formal environment to do outside of school but still be structured and tired. Research Saribas, Kucuk, and Ertepinar [9] found that the perceptions and attitudes of pro-environment candidates for primary school teachers increased by better by learning outside the classroom, such as a visit to the exhibition of the environment, or the pattern of the course. Departing from some of these findings, it can be concluded that the low carbon environmental education and education should ideally be carried out with an alternative method that combines formal and non-formal, in order to provide comfort and optimal outcomes for learners. The use of teaching materials neighbourhood would be very significant in the process of low carbon environmental education and education.

Environmental education is very important at this time because the world has experienced an imbalance (disequilibrium). Total energy sources continue to decrease, while the level of demand for energy continues to rise, while on the other levels of air pollution, especially greenhouse gases increase. This should be a concern for us all. United Nations Development Program suggested that the energy position is very central to the achievement of sustainable development objectives, at least in two main ways. First, energy is positioned as an instrument for achieving the goals of sustainable development. Second, the production and consumption of energy resources must be accompanied by efforts to improve the ability of ecosystems; local and global; to ensure the sustainability of the world to the next. Challenges ahead for sustainable development exist in the energy industry is how to expand and improve access to energy technologies, while the impact of energy use on the environment continues to increase [6]. This reality becomes irrefutable argument that environmental education currently running at all levels should be directed and focused on the education of low carbon.

3.2. Environmental Literacy
Goldman, Assaraf, & Shahabarani [10] states that the sustainability is determined by environmental literacy skills possessed by the public. And environmental education is a tool for building the environmental literacy. Environmental literacy is a level of knowledge, awareness, and individual behaviour’s associated with their environment, this capability is not abstract but real and can be measured with quantitative standards though [11]. Environmental literacy is essentially very easy to apply, some examples of the easiest actions related to environmental literacy can we teach and apply that reduce the use of environmentally harmful materials such as paper, paper towels, and plastic [12]. Tuncer et al identified there are four components that become constituent of environmental awareness (environmental literacy) each individual that is the attitude, knowledge, perception, and environmental concerns [13]. To provide a thorough mastery of the four components of the environmental literacy to students, then in the process, environmental education should be oriented content, inquiry, nature of science, and Science-Technology-Society [14].
3.3. Low Carbon Teaching Materials

Teaching materials or books is one of the educational tools used deliberately and to achieve educational goals [15]. Teaching materials is basically a process of learning tools that organize information, materials, and textbooks needed by educators for learning implementation in a single container, generally in the form of books, modules, LKS, etc. Seguin (1989) stated that the textbooks and other teaching materials is a tool in the teaching-learning process and should be related to the curriculum as an object, the content and teaching methods in accordance with the areas of focus [16]. Teaching materials are a means of knowledge transfer from researchers/scientists to the reader. Then the reader characteristics are also taken into consideration in the packaging process information (knowledge) into a resource. Textbook is a pattern of packaging materials that are packed with reference to the substance defined by the curriculum so that a book like this kind generally used only in the world of schooling. While the teaching materials are more open with regard to the substance of the material presented, the presentation is also more flexible and can be read by the entire community.

Afonso and Gilbert's research shows that the chemistry book was able to grow interested more of the public to chemicals. Afonso and Gilbert also provides some recommendations with regard to the development of teaching materials, (1) start of many things happening in the community, (2) show the alignment in the writing/discussion of the substance, (3) limit the depth and breadth discussion, (4) come up with a strong link between discussion and needs of readers, (5) include some activities as a reinforcement of the theories discussed, (6) seek substance discussed also include material in the world of schooling [17]. Low carbon education teaching materials developed in order to provide a scientific explanation of the phenomenon or reality that regard with many low carbon cases in people's daily lives. The compiling process of this teaching materials begins with the identification and observation of phenomena/reality in people's lives. Further to an analysis of such information, analysis, or evaluation in order to ensure that it is correct that in the context of low carbon education. These contexts subsequently made a scientific explanation that presented in a scientific-generic-scientific scheme. Next will be produced some material substance (content) are then constructed into a teaching material for low carbon education is intact.

![Figure 1. Logic Model of Low Carbon Education Teaching Materials.](image-url)
In terms of presentation, delivery of low carbon content in this teaching materials using three components: narrative, illustrations, and activities. Negrete in Afonso and Gilbert, found that the use of narration is an interesting and fun way to teach scientific knowledge, in addition to the narrative could also last longer in the memory of the reader [17]. The use of good illustrations of tables, graphs, or infographics used to convey information in the form of data or equations, in addition, of course, to make the materials more attractive. The illustrations used to complement the narration, which could be an alternative route to provide understanding. With such diverse delivery, expected later teaching materials low Carbon education This can be accepted in all circles so that the reader has a spacious room in an effort to provide an understanding of carbon emissions and the impact on the environment, and could subsequently become the scientific basis for them to live a low carbon life.

![Diagram: Low Carbon Teaching Materials](image)

**Figure 2.** Content Presentation Scheme in *Low Carbon Education* Teaching Material.

### 4. Conclusion

Environmental education today must promote low carbon education, because energy and emissions are sources of the greatest environmental problems that threaten Earth. Implementation of environmental education using alternative methods (a combination of formal-nonformal) into things that should be run to accelerate the growth of the younger generation environmental literacy. low carbon education teaching materials departing from the phenomenon/social realities of society, compiled on the basis of evaluative thinking, served in an elegant, content delivery more flexible, and are equipped with illustrations and activities of interest will allow the younger generation and the public to learn and develop their environmental literacy based on each awareness.

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