



The Role of Educational Curriculum Implementation in Climate Change Mitigation

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Abstract. The issue of climate change has become the most challenging discussion in its development. In the late 19th century, the average global temperature increased by 1.1 degrees Celsius, shifting significant physical changes to all countries in the world. Consistently changing the business order, supply chain, and how the welfare of the community, especially those that depend on the weather. The agreement of many countries at the UN forum, the Tokyo protocol, Paris, has not been able to change the environment significantly. Changes in the environment and the way humans behave are important keys to improving the earth. Education is one of the pillars to provide understanding to every level of society about the importance of preserving the environment. Our students today are citizens of society who will live in the future. But unfortunately, apart from the challenges in implementation, and inadequate support. Many studies explain that students also have not changed their consciousness at the optimal point. Education by involving students connected to their environment is expected to be a solution, on the other hand environmental awareness must be changed on a collective scale, no longer individual. Awareness about the environment can be raised from their homes by starting to use the 3R principles (Recycle, reuse, reduce). We find the curriculum provided by the government through the ministry of education and culture already has some that are related to the environment, climate change and disaster, but in practice the challenge identified includes limited teacher capacity, a lack of practical guidelines, limited financial support and a lack of a unified set of criteria and guidelines for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) education.

Keywords: Climate Change · Curriculum · Education · Mitigation

1 Introduction

Climate change is the most pressing issue and has the farthest impact on all countries in sustainable development. Since the 1880s, the average global temperature has increased

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by 1.1 degrees Celsius [1], shifting significant physical changes to all countries in the world. The main source of the increase in temperature over the past two centuries is the increase in CO₂, glassware, and nitrogen in the Earth's atmosphere [2]. Since the start of the industrial revolution in the mid 18th century, human activities have released 2.5 trillion to CO₂ into the atmosphere, increasing the percentage of its concentration up to 67% [1]. The global response that has been carried out, among others, is that countries have signed agreements to eliminate climate change in their respective regions. The first agreement was the UN convention on climate change, which was inaugurated at the 1992 Earth Summit [3]. The Tokyo Protocol, which was launched to strengthen the global response to climate change, was followed in 2008 which was implemented at the end of the 2012 period. While emission targets of countries were lowered significantly, Rosen [4] argues that the term protocol is an inappropriate solution in time. This is because the emission reduction target is implemented in a short time of action.

If we don't do anything significant, according to Christopher [5], the earth will be getting hotter. In India, by 2030 several 160 million to 200 million people will be at risk of being hit by a deadly heatwave. By 2050, parts of India may be under such intense heat and humidity stress that working outside the home will not be safe for 30% of the day. In the United States, rising sea levels, increasing tidal flooding, and storm surges more severe than hurricanes are likely to threaten Florida's fragile coastline. On the supply chain is also influential, once in 100 years hurricane in the west pacific, which will become 4x more likely by 2040, could close the semiconductor supply chain [5]. According to our findings in articles [6–9], education is one of the pillars of change in our society. Educating the public about climate change is an important measure to influence populations at all levels of society including school, children, farmers, and the general public to take an active role in mitigation and adaptation actions. Even Nikendei [10] stated that, teaching students about climate change as a socially important scientific issue prepares them for democratic participation when they decide and adopt positive environmental behaviors.

Children, youth, and young adults are those most affected by climate change, because they will live in the future. They should be encouraged from an early age to recognize the climate-related risks and possible actions. This generates an urgency for learners at all school levels to deal with these significant challenges for their current and future living environments [11]. Education can play an important role in supporting Indonesia's national greenhouse gas reduction policies by communicating about climate change and raising environmental awareness, including by school children learn [12]. We must tell students about climate change as a global environmental problem. Like Indonesia, in some countries around the world, climate change may not be a "big" issue for high school students. The survey found that a significant percentage of the 8th graders and her 11th graders were unable to pinpoint the root causes of climate change in Greek, and that he was able to give the correct answer in answering the root causes was 344 only 33% of her 8th graders and 43% of her 282 11th graders of climate change [13]. In another study, 52% of 646 7th grade students in Turkey reported having heard of climate change, but only 29.9% said it would be devastating [14]. Additionally, research shows that her 10th graders (including teachers) in Queensland, Australia, have low understanding and

knowledge of climate change. Climate change can therefore become a less important topic for students around the world.

About DRR and CCA has not yet been demonstrated or consistently addressed in the school curriculum in Indonesia. The challenge identified includes limited teacher capacity, a lack of practical guidelines, limited financial support and a lack of a unified set of criteria and guidelines for DRR and CAA education [15]. Even though, online game-based learning, as a new model of learning activity is very promising to be an effective and efficient learning method, especially learning related to climate change issues. Online game-based learning in line with the spirit of internationalization of higher education where learning must be carried out anytime, anywhere, and by anyone. Based on the description above, this paper aimed 1) Knowing the current education curriculum can accommodate the issue of climate change, 2) Knowing the application of the ideal educational curriculum to address the issue of climate change.

2 Methods

2.1 Data Source

The nature of the research using descriptive analysis method by reviewing various literatures. The source of information in the preparation of this paper utilizes secondary data through literature studies of relevant research on the role of education in climate change mitigation. The main literature sources were taken from ProQuest, ScienceDirect, Scopus, and ResearchGate.

The data collection method in writing this paper is the literature review method, which is a systematic, clear and iterative method in identifying, evaluating, and synthesizing research results produced by researchers and practitioners [16]. This method is used to assess and interpret secondary data related to the research question. The preparation of the review is carried out starting from the preparation of the review by first finding a problem in the research, setting research questions, making goals and keywords used in the literature search [17].

2.2 Literature Search Strategy

The literature search strategy uses a search for published articles on ProQuest, ScienceDirect, Scopus and ResearchGate by writing down the selected keywords, namely: mitigation, climate change, curriculum, and education Table 1.

Table 1. Sources of Data Base Literature Search Database

Research Database	Web Address
ResearchGate	https://www.researchgate.net/
ProQuest	https://www.proquest.com/
ScienceDirect	https://www.sciencedirect.com/
Scopus	https://www.scopus.com/

Table 2. Inclusion criteria

Criteria	Inclusion
Time period	2010–2022
Subject	Climate change
Journal type	Research article, full text pdf
Theme content	Education in climate change mitigation

This Literature Review uses literature published in 2010–2022 which can be accessed in full text in pdf format. Journals that match the inclusion criteria and have a theme of the relationship between the role of educational curriculum implementation in climate change mitigation are then reviewed. Inclusion criteria are research subjects who can represent research samples that qualify as samples [18]. The journal criteria selected for review are journals in which there is a theme of the relationship between education and society with climate change mitigation. The research inclusion criteria can be seen in the following Table 2.

Based on the inclusion criteria, a total of 8 articles were eligible for analysis.

2.3 Analysis Techniques

The analysis technique in this paper is an inductive technique. This data analysis technique is analysis technique which is carried out by comparing sources literature related to the research focus or in other words Inductive method is data analysis that departs from factors that are specific in nature to draw conclusions that are general [18]. According to Terrel [19], data collected from sources is then analyzed inductively with the idea that the results can be used to better understand a particular event or scenario.

This review is compiled using the narrative method by grouping similar extracted data according to the measured results to answer the objectives. Research journals that meet the inclusion criteria are then collected including the title of the paper, the year of publication of the journal, the name of the researcher, and a summary of the results or findings. Based on the outline or essence of the research, it is then described in a sentence, looking for similarities and differences in each study and then discussed to draw conclusions.

3 Result and Discussions

3.1 Result

The following are the results of a review of articles related to the topic of discussion Table 3.

Table 3. Literature Review

Article Name / authors	Finding
<p>“Climate change education for universities: A conceptual framework from an international study” - Petra Molthan-Hill, Nicholas Worsfold, Gustavo J. Nagy, Walter Leal Filho. 2018.</p>	<ul style="list-style-type: none"> ● Universities have the potential to play a key role in combating climate change ● It is important to understand the range of implementation strategies chosen globally by Higher Education Institutions to address climate change education ● Four approaches are highlighted: Piggybacking, mainstreaming, specializing and connecting (transdisciplinary) ● Practical examples show how climate change education may be implemented across the world
<p>“Green returns to education Do education affect pro-environmental attitudes and behaviors in China” - Wang Q, Niu G, Gan X, Cai Q. 2022.</p>	<ul style="list-style-type: none"> ● Knowledge and information about environmental issues might increase individuals’ sense of environmental responsibility. ● Education might increase the marginal utility of pro-environmental behaviors by enabling people to pursue a higher level of demand ● The majority of Chinese respondents engage in pro-environmental behavior on a regular basis. ● Rural residents display less pro-environmental behaviors than people in urban areas. This is probably because urban residents have more opportunities to perceive the importance of environmental issues, such as the information from media publicity, and therefore have higher incentives to conduct pro-environmental behaviors ● The acquisition of environmental knowledge is the channel that drives the effect of education on pro-environmental attitudes and behaviors.

(continued)

Table 3. (continued)

Article Name / authors	Finding
<p>“Challenges and Opportunities for Climate Change Education (CCE) in East Africa: A Critical Review” - Abigael Apollo and Marcellus Forh Mbah. 2021.</p>	<ul style="list-style-type: none"> ● Educating people on climate change is a vital measure to persuade populations at all community levels including school children, farmers, and the general population to play an active role in mitigation and adaptation action. ● Teaching students on climate change as a scientific issue of social importance prepares them for democratic participation as they decide and adopt positive environmental behaviors. ● Primary and secondary students also need climate knowledge, as they will have to make climate policy decisions. Thus, they need to have an informed perspective.
<p>“The (Un)political Perspective on Climate Change in Education—A Systematic Review” - Johanna Kranz, Martin Schwichow, Petra Breitenmoser and Kai Niebert. 2022</p>	<ul style="list-style-type: none"> ● Education can only live up to this expectation and unfold its transformative potential if effective opportunities, such as public-sphere action in contrast to individual action, and mitigating and adapting to climate change, are addressed. ● Great potential for implementing public-sphere action in educational programs at school levels. Our analysis further shows that key aspects of climate policy such as the 1.5 °C limit, IPCC reports, or climate justice are rarely addressed in interventions. ● As effective mitigation and adaptation rely on public-sphere actions, we conclude that effective climate education should discuss these public actions if it is to be effective.

(continued)

Table 3. (continued)

Article Name / authors	Finding
<p>“Identifying effective climate change education strategies: a systematic review of the research” - Martha C. Monroe, Richard R. Plate, Annie Oxarart, Alison Bowers & Willandia A. Chaves. 2017.</p>	<ul style="list-style-type: none"> ● Two themes were identified that are common to most environmental education: (1) focusing on personally relevant and meaningful information and (2) using active and engaging teaching methods. ● Four themes specific to issues such as climate change were also generated: (1) engaging in deliberative discussions, (2) interacting with scientists, (3) addressing misconceptions, and (4) implementing school or community projects.
<p>“The impact of climates changes to livelihood vulnerability for smallholders farmers in wonogiri, Indonesia” - Suryanto, E S Rahayu, O P Astirin, F Susilowati. 2022</p>	<ul style="list-style-type: none"> ● Climate change greatly affects human life and causes poverty ● In measuring regional vulnerability, a more specific and unique approach is needed for the area, because it is not always areas affected by climate change that always have a higher level of vulnerability. ● Climate change is very influential in life, especially in agriculture which causes difficulties in harvesting and can also cause natural disasters in areas prone to natural disasters.
<p>“Climate literacy: a systematic review and model Integration” - José Azevedo and Margarida Marques. 2017.</p>	<ul style="list-style-type: none"> ● The case of climate change was used as a situational prototype that helps to unite broad communication issues and established knowledge. The choice of this case is justified by the current international interest and calls for the development of a climate-literate public. ● Further research should be performed regarding climate change misconceptions, particularly their pervasiveness and how to address them in formal and non-formal learning.

(continued)

Table 3. (continued)

Article Name / authors	Finding
<p>“Online game-based learning on climate change: innovation in the internationalization of higher education” - P Wiratama, D G S uharto and I D A Nurhaeni. 2021</p>	<ul style="list-style-type: none"> ● It turns out that education is one of the important roles in creating awareness and understanding about climate change so that people can overcome it. But there are still many obstacles in learning, one of which is a boring learning process. ● For people whose learning method prefers to use the audio-visual method, online game-based learning (OGBL) is very beneficial, and it is also designed for all groups, including the general public, students, and professionals. ● This OGBL is interesting so that people are more curious about the issue of climate change and find out more and finally form a sense of concern

3.2 Discussions

Based on the findings above, it is concluded that education is an important component to influence the climate change mitigation process. There is even a fundamental difference between urban communities who have better access to education and information, than rural communities, who have limited access to education. Hence, that the findings in this article as well as answer the research questions are as follows:

- That the curriculum provided by the government through the ministry of education and culture already has some that are related to the environment, climate change and disaster. But in practice the challenge identified includes limited teacher capacity, a lack of practical guidelines, limited financial support and a lack of a unified set of criteria and guidelines for DRR and CCA education.
- The content of the existing curriculum should use a more dominant practical approach, provide practical guides that make it easier to use and increase the capacity of teachers to carry out appropriate teaching.

However, as a consideration in the above study, it is necessary to put forward the following points as discussion.

Bringing the learning curriculum (especially in the field of environment and social studies) closer to material that is relevant and related to student life, schools and environmental issues that are close to student life related to climate change.

Collaborating on each material that is studied and guided by the issue of how it plays a role in its contribution to mitigating climate change issues. Projects in learning are brought closer to climate change mitigation education and campaigns (practice-oriented).

Since climate change is a collective issue of society, the approach does not only move individual students but also touches on the collective movement. Starting from their respective homes.

Starting from the school and classroom environment, we have started to get used to environmental care movements, such as reducing the use of excess paper (replaced with online mode), saving on clean water, and using environmentally friendly items (recycle, reuse, reduce).

The formal education community is a strategic target group. Formal education plays a very important role in creating the behavior of the nation's next generation that is active in overcoming the problem of climate change, through inculcating the values of life and implementing environmentally friendly practices.

4 Conclusion and Recommendations

From the results of our identification in this paper, it can be concluded that education is one of the important roles to support the community, especially children and adolescents, to be more concerned about mitigating climate change, because this is an urgency for them to be better prepared to face challenges in their current environment. This and the future. Education has enormous potential and opportunity in making people more concerned about climate change mitigation. Because knowledge and facts about environmental information can increase an individual's sense of responsibility towards the environment. Curriculum related to DRR and CCA has been provided by the Government, but there are still shortcomings in its implementation, limited teacher capacity, lack of practical guidelines that can show how climate change education can be implemented, limited financial support, lack of integrated criteria and guidelines for DRR education and CCA. A practical approach is needed here to increase student and environmental awareness in the implementation of learning.

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