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Climate Change and Modern Education: Preparing for a Sustainable Future

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Abstract:

Climate change is a global phenomenon that has attracted widespread attention in recent decades due to its profound impact on the environment and society. Although climate change is a phenomenon occurring since the inception of Earth, anthropogenic activities such as fossil fuel consumption due to industrialization, transportation and domestic usage, deforestation and land use changes due to urbanization have accelerated the process. Climate education has become an important part of modern education as it helps raise awareness of the issue and promote behavior of climate consciousness which leads to climate action in a positive direction. The authors highlight the values of interactive and engaging platforms to educate students about climate change and its impacts. The article focuses on origin and implications of climate change education and international and national bodies that have provided an all inclusive curriculum for climate education. The authors argue the need to focus on climate education especially in vulnerable communities to reduce disparities in climate change education to address the climate crisis.

Keywords: climate change, climate education, K12, sustainability, UNCCLearn, UNESCO, UNAI

Introduction

Climate change is a gradual, long-term and unpredictable process, which manifests itself in the form of changes in temperature and weather patterns [1]. Its origin can be from natural causes which is termed as climate variability or it can be driven by anthropogenic activities (human-driven) which is the main focus of the 21st century [2]. With the advent of industrialization since the 1800's, human driven climate change has surfaced radically and its impacts are a serious concern. In the last two hundred years, accelerated industrial activities, along with a rising human population, created enormous impact on the local, regional and global climate, and their consequences are finally being recognized and felt by the communities worldwide. For example, the effects of climate change are being experienced worldwide - severe droughts in the Horn of Africa and Europe [3, 4], wildfires in North America [5], floods in Pakistan [6]. February 2023 recorded the highest temperatures above normal since 122 years and according to the Indian Meteorological Department reports [7], and others such as the National Weather Service [8]. We, as researchers with expertise in education and climate science, hold the belief that educating the younger generation is a crucial step towards addressing the urgent issue of climate change. By providing critical education about climate change, we can equip young learners with the necessary knowledge and skills to prepare for the impending environmental crisis that lies ahead. Although

some readers may find the seriousness to be inconsequential, many prominent science outlets say otherwise [9-10]. From a literary standpoint, educating K12 learners about critical climate change fortifies them with the knowledge and tools they need to understand the causes and effects of climate change [11]. Unlike traditional education where learners sit in a classroom as instructors go about reciting their usual “scripts”, there is a need to tailor climate change education to make it more impactful and meaningful, so it inspires learners to take action and make changes in their own lives to become more climate conscious, be prepared for climate emergencies and be more resilient to take action.

Origins of Climate Change Education

The advent of climate change education has evolved alongside the domain of climate change research [38]. The roots of climate change education can be traced back to the early 1990s. At the time, there was a growing awareness of the negative impact of human activities on the environment, and the need for greater public understanding of this issue. In response to these concerns, the United Nations Framework Convention on Climate Change (UNFCCC) was established in 1992 with a goal to reduce greenhouse gas emissions and mitigate the effects of climate change [12, p. 184]. Stemming from this climate movement, other international advocacy bodies such as the United Nations Environment Program (UNEP), the Intergovernmental Panel on Climate Change (IPCC), and the United Nations Educational, Scientific and Cultural Organization (UNESCO) have played a pivotal role in promoting climate change education around the world [13-15].

Over time, the climate education movement gained momentum, and has been widely adapted by numerous institutions. Some of the most prominent institutions in this regard include Stanford University and Yale University, both of

which have established programs and initiatives focused on climate change education [16-17]. Additionally, collaborative research institutions such as the University Corporation for Atmospheric Research (UCAR) and the National Center for Atmospheric Research (NCAR) have been instrumental in developing and disseminating information on climate change to educators and the general public [18, 19]. The need for climate change education has been recognized globally, with several initiatives emerging in various regions around the world. For instance, the European Union has funded literacy programs such as Erasmus+ Climate Change Education [20], while in Australia, the Climate Action Australia initiative has been established to provide educational resources on climate change [21]. In the Indian subcontinent, the Center for Science and Environment has been working to promote climate education in the nation [22], while several African and other developing countries have repurposed their existing curriculum to include critical climate education for learners from all grades and backgrounds [23]. The result of these efforts has been the creation of a range of educational resources, including online courses, toolkits, lesson plans, and educational games, which can be used by educators and learners across the world. These are just a few examples among a plethora of institutions that have made such resources available for public use.

Implications for Modern Education in Climate Context

Climate change is a complex, multifaceted problem that requires innovative teaching solutions. Modern education has proven to be advantageous in comparison to traditional methods of knowledge dissemination [24]. With the advent of digital devices and online learning, the accessibility to educational content and resources have risen drastically. Especially in the COVID-19 era, our reliance on digital learning

has increased manifold, although with an overall unsatisfactory learning outcome [25-26]. Historically, lateral factors like learner motivation, lack of financial resources, and socio-cultural norms have limited digital learning's impact in low and medium economies. Recently, researchers have developed a digital divide framework addressed to the development and increased adoption of online learning during the pandemic [27]. Nevertheless, we believe this situation presents us with an opportunity to rethink effective ways of practicing critical climate change education.

Climate education is of great societal significance as it can embed and nurture a sense of climate consciousness within students and encourage the spread of awareness in the community. Using learner-centered pedagogical techniques, such as project-based, problem-based, interactive game-based and multi-modal ways of learning, climate education creates interconnectedness of environmental, socio-economic and cultural systems, and therefore, has led to a greater awareness of the environment and sustainability [28-32]. These skills can be applied not only to climatic and environmental challenges, but also have potential to be scaled to other areas of life.

From a social justice and equitable education perspective, climate change has a disproportionate impact on marginalized communities, especially the ones who are often termed "climate-refugees" [33]. Magni highlights the significance of involving indigenous communities, who are most vulnerable to climate hazards, as active participants rather than mute spectators [39]. These communities have their own strategies for addressing climate disasters based on their indigenous knowledge. Integrating these indigenous approaches into climate change research and educational curricula, in

conjunction with technology, can lead to maximum benefits.

An all-inclusive climate education curriculum could assist education stakeholders, such as students, teachers and administrators, in comprehending these socio-economic, cultural and educational disparities within their own communities, and prepare them for effectively addressing the climate crisis by creating more engaged and informed citizens. The Lancet Planetary Health Journal also corroborates with this idea [34].

An example of an all-inclusive ready-to-use climate literacy initiative is developed by the United Nations Climate Change Learning Partnership (UNCC eLearn) which offers many online climate change courses at free of charge. These include self-paced learning models that are open to the public [35]. Their courses are aligned with various sectors such as impact on finance, energy, food, health, gender and many other areas. This is an example of an all-inclusive critical climate education as it takes into account most of the global climate issues, including effects, causes, challenges, how those issues impact other industries, and provides learners with mitigating strategies for a sustainable future and preserve the planetary health.

One purpose-built example is from the African nations of Ethiopia whose climate curriculum focuses especially on the effects, challenges and mitigation of droughts, as droughts are the most frequent, and one of the intense climate extreme events faced in their locations. Whereas learners in the US typically focus on geographically-relevant events such as tornadoes, wildfires, and snowstorms [23]. These climate specific curricula have been developed for the nations in collaboration with UNESCO.

The United Nations Academic Impact (UNAI) is another global initiative that aims to foster collaboration between universities and the UN to promote sustainable development and tackle global challenges, including climate education [36]. One key issue that UNAI seeks to address is the North-South Divide, which refers to the disparities in wealth, development, and access to resources between developed and developing countries. In February 2023, the third UN Open Science Conference was held in New York, USA with a main goal that mirrors UNAI's mission - to break boundaries of the North-South divide and share scientific knowledge, technology and resources for the holistic development of the planet [37]. These international cooperative movements have a positive impact on sharing of research and knowledge across haves and have nots throughout, thus diminishing the existing North-South gap.

Conclusion

This article is a general overview of climate change education and its relevance in modern education. We emphasize the necessity of incorporating climate change curriculum into the modern education system with a hope that educational leadership creates a holistic, interactive and all-inclusive educational approach. Finally, we conclude by stating climate education has the potential to promote international cooperation and collaboration.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] J. Romm, *Climate Change: What Everyone Needs to Know*. Oxford University Press, 2022.
- [2] T. J. Crowley, "Causes of Climate Change Over the Past 1000 Years," *Science*, vol. 289, no. 5477, pp. 270–277, Jul. 2000, doi: [10.1126/science.289.5477.270](https://doi.org/10.1126/science.289.5477.270).

- [3] "Another poor rainy season forecast for drought hit Horn of Africa," *World Meteorological Organization*, Feb. 22, 2023. <https://public.wmo.int/en/media/news/another-poor-rainy-season-forecast-drought-hit-horn-of-africa> (accessed Mar. 10, 2023).
- [4] C. Barnett, "Europe's water crisis is much worse than we thought," *National Geographic*, Dec. 06, 2022. Accessed: Mar. 10, 2023. [Online]. Available: <https://www.nationalgeographic.com/environment/article/europes-water-crisis-drought-worse-grace>
- [5] "Climate Change Indicators: Wildfires," *US EPA*, Jul. 01, 2016. <https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires> (accessed Mar. 10, 2023).
- [6] I. Nabi, "Responding to Pakistan floods," *Brookings*, Feb. 10, 2023. Accessed: Mar. 10, 2023. [Online]. Available: <https://www.brookings.edu/blog/future-development/2023/02/10/pakistan-floods/>
- [7] IMD_IT_TEAM, "Home," *India Meteorological Department*. <https://mausam.imd.gov.in/> (accessed Mar. 10, 2023).
- [8] "National Weather Service," *Graphical Forecast*. <https://digital.weather.gov/> (accessed Mar. 10, 2023).
- [9] T. Bernauer, "Climate Change Politics," *Annual Review of Political Science*, vol. 16, no. 1, pp. 421–448, May 2013, doi: [10.1146/annurev-polisci-062011-154926](https://doi.org/10.1146/annurev-polisci-062011-154926).
- [10] "Climate change impacts," *National Oceanic and Atmospheric Administration*. <https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts> (accessed Mar. 12, 2023).
- [11] "Why is climate important?," *NCAS*. <https://ncas.ac.uk/learn/why-is-climate-important/> (accessed Mar. 12, 2023).
- [12] S. Gardiner, S. Caney, D. Jamieson, and H. Shue, *Climate Ethics: Essential Readings*. Oxford University Press, 2010.
- [13] E. Paglia and C. Parker, "The Intergovernmental Panel on Climate Change: Guardian of Climate Science," in *Guardians of Public Value*, Cham: Springer International Publishing, 2020, pp. 295–321. Accessed: Mar. 12, 2023. [Online]. Available: http://dx.doi.org/10.1007/978-3-030-51701-4_12
- [14] N. Hall, *Displacement, Development, and Climate Change: International Organizations Moving Beyond Their Mandates*. 2016.
- [15] I. D. Bunn, I. Hronszky, and G. L. Nelson, "The United Nations and Climate Change: Legal and Policy Developments," in *AIP Conference Proceedings*, 2009. Accessed: Mar. 12, 2023. [Online]. Available: <http://dx.doi.org/10.1063/1.3208033>
- [16] "Climate Change Education," *Stanford Doerr School of Sustainability*.

- <https://earth.stanford.edu/climate-change-ed> (accessed Mar. 10, 2023).
- [17] “Home,” *Yale Program on Climate Change Communication*, Jul. 29, 2015. <https://climatecommunication.yale.edu/> (accessed Mar. 12, 2023).
- [18] “University Corporation for Atmospheric Research,” *UCAR*. <https://www.ucar.edu/> (accessed Mar. 10, 2023).
- [19] “National Center for Atmospheric Research,” *NCAR*. <https://ncar.ucar.edu/> (accessed Mar. 10, 2023).
- [20] “Climate Change Education,” *Climate Change Education | Erasmus+ project financed by the European Union*, Nov. 02, 2019. <https://ccedu.erasmus-projects.eu/> (accessed Mar. 10, 2023).
- [21] “Organisations taking action,” *Climate Action Australia*, Feb. 19, 2020. <https://climateactionaustralia.net.au/information/organisations-taking-action/> (accessed Mar. 10, 2023).
- [22] “Centre for Science and Environment,” *cseindia.org*. <https://www.cseindia.org/> (accessed Mar. 10, 2023).
- [23] “CLIMATE CHANGE COMMUNICATION AND EDUCATION,” *Education Profiles*. <https://education-profiles.org/themes/-/climate-change-communication-and-education> (accessed Mar. 10, 2023).
- [24] R. Elmore, “Getting to Scale with Good Educational Practice,” *Harvard Educational Review*, vol. 66, no. 1, pp. 1–27, Apr. 1996, doi: 10.17763/haer.66.1.g73266758j348t33.
- [25] S. Nikou and I. Maslov, “An analysis of students’ perspectives on e-learning participation – the case of COVID-19 pandemic,” *The International Journal of Information and Learning Technology*, vol. 38, no. 3, pp. 299–315, May 2021, doi: [10.1108/ijilt-12-2020-0220](https://doi.org/10.1108/ijilt-12-2020-0220).
- [26] A. R. Masonbrink and E. Hurley, “Advocating for Children During the COVID-19 School Closures,” *Pediatrics*, vol. 146, no. 3, Sep. 2020, doi: [10.1542/peds.2020-1440](https://doi.org/10.1542/peds.2020-1440).
- [27] A. Mathrani, T. Sarvesh, and R. Umer, “Digital divide framework: online learning in developing countries during the COVID-19 lockdown,” *Globalisation, Societies and Education*, vol. 20, no. 5, pp. 625–640, Sep. 2021, doi: [10.1080/14767724.2021.1981253](https://doi.org/10.1080/14767724.2021.1981253).
- [28] M. Genc, “The project-based learning approach in environmental education,” *International Research in Geographical and Environmental Education*, vol. 24, no. 2, pp. 105–117, Dec. 2014, doi: [10.1080/10382046.2014.993169](https://doi.org/10.1080/10382046.2014.993169).
- [29] D. Wróblewska and R. Okraszewska, “Project-Based Learning as a Method for Interdisciplinary Adaptation to Climate Change—Reda Valley Case Study,” *Sustainability*, vol. 12, no. 11, p. 4360, May 2020, doi: [10.3390/su12114360](https://doi.org/10.3390/su12114360).
- [30] C. McGibbon and J.-P. Van Belle, “Integrating environmental sustainability issues into the curriculum through problem-based and project-based learning: a case study at the University of Cape Town,” *Current Opinion in Environmental Sustainability*, vol. 16, pp. 81–88, Oct. 2015, doi: [10.1016/j.cosust.2015.07.013](https://doi.org/10.1016/j.cosust.2015.07.013).
- [31] D. Fernández Galeote and J. Hamari, “Game-based Climate Change Engagement,” *Proceedings of the ACM on Human-Computer Interaction*, vol. 5, no. CHI PLAY, pp. 1–21, Oct. 2021, doi: [10.1145/3474653](https://doi.org/10.1145/3474653).
- [32] G. B. Petersen, S. Klingenberg, R. E. Mayer, and G. Makransky, “The virtual field trip: Investigating how to optimize immersive virtual learning in climate change education,” *British Journal of Educational Technology*, vol. 51, no. 6, pp. 2099–2115, Jul. 2020, doi: [10.1111/bjet.12991](https://doi.org/10.1111/bjet.12991).
- [33] J. Schwarz, “Climate Change, Human Displacement, and STEM Education: Toward a More Transdisciplinary and Inclusive Culture of Science,” in *Migration, Displacement, and Higher Education*, Cham: Springer International Publishing, 2023, pp. 219–231. Accessed: Mar. 10, 2023. [Online]. Available: http://dx.doi.org/10.1007/978-3-031-12350-4_18
- [34] A. Bonell *et al.*, “Equity in planetary health education initiatives,” *The Lancet Planetary Health*, vol. 7, no. 1, pp. e6–e7, Jan. 2023, doi: [10.1016/s2542-5196\(22\)00142-5](https://doi.org/10.1016/s2542-5196(22)00142-5).
- [35] “One UN Climate Change Learning Partnership.” <https://uncclearn.org/> (accessed Mar. 10, 2023).
- [36] U. Nations, “About UNAI,” *United Nations*. <https://www.un.org/en/academic-impact/page/about-unai> (accessed Mar. 10, 2023).
- [37] U. Nations, “Open Science Conference 2023,” *United Nations*. <https://www.un.org/en/library/OS23> (accessed Mar. 10, 2023).
- [38] K. C. Busch, J. A. Henderson, and K. T. Stevenson, “Broadening epistemologies and methodologies in climate change education research,” *Environmental Education Research*, vol. 25, no. 6, pp. 955–971, Oct. 2018, doi: [10.1080/13504622.2018.1514588](https://doi.org/10.1080/13504622.2018.1514588).
- [39] G. Magni, “Indigenous knowledge and implications for the sustainable development agenda,” *European Journal of Education*, vol. 52, no. 4, pp. 437–447, Sep. 2017, doi: [10.1111/ejed.12238](https://doi.org/10.1111/ejed.12238).