



COMMUNICATION

Climate Change Education, Globalisation and the Nation State: A Commentary on Ghana's Science Curriculum

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Abstract

In this paper, we offer a commentary on the climate change content in Ghana's primary and junior high school science curriculum. Since 2019, the government of Ghana has mandated climate change education at multiple levels of the school system. However, there is very little analysis of these curricula. This paper fills an important gap by critically reviewing the climate change content in the science curriculum in a country with a complex and tenuous past regarding capitalist and colonialist expansion and exploitation. We note that while the curriculum attends to technical details of greenhouse gas emissions and climate impacts, it elides the larger global context that has led to the rise in carbon emissions and anthropogenic climate change. We make the case for a climate change curriculum that integrates culture, language and histories, and tackles the complexities of globalisation.

Keywords: Climate change; culture; curriculum; Ghana; globalisation; government

Background

In 2015, a major flooding event negatively impacted the lives of 53,000 people in Ghana's coastal cities and towns (Hallegatte & Erman, 2018). The floods raised concerns and questions about Ghana's readiness for climate-related events, its urban planning and the country's social and physical infrastructure. In another climate-related event, a prolonged drought caused food insecurity in Ghana in the turbulent 1980s, against a backdrop of British imperialism, the independence movement, military coup d'états, and economic returnees from Nigeria (Dei, 1988). One of the author's parents is a part of that generation. Ghana has always been a country in transition, and in our own lifetimes, we have seen our country become urbanised, shift from a mostly agrarian economy to a service economy, socio-cultural changes and class mobility. These changes have improved the wellbeing of Ghanaians in some respects. But have also exposed some political and cultural rifts, class inequities and devastating consequences for the natural environment. Ghana's rivers, oceans, forests and grassland have become sites of extraction and children and youth continue to be marginalised by these exploitative activities hindering their access to clean air, water and uninterrupted school days. Climate Change presents a unique threat in that it may exacerbate already existing structural challenges and increase Ghana's vulnerability to some of the devastating historical climate events described above. Children and youth are particularly susceptible to the rising sea levels, diseases, food shortage and insecurities associated with climate change (Odonkor et al., 2020). It is important to mention, several stakeholders in

Ghana such as the government, civil society and international organisations such as the United Nations, local chiefs and community leaders recognise the deleterious impacts of climate change on the flourishing of children and youth in Ghana.

In light of the above, climate change education has been implemented by the government of Ghana as one of several climate adaptation and mitigation strategies in Ghana. At the moment, climate change content is embedded in several primary and secondary school subjects such as Science, Creative Arts, Religious & Moral Education etc. (Appendix A & B). However, in this paper, we limit our commentary/critique/analysis to the primary and junior high school science curriculum. Our critique is steeped in Ghana's Colonial and Capitalist exploitation and its current trajectory of neoliberal development.

Why focus on the science curriculum?

We focused on the science curriculum for two reasons- Ghana's developmentalist vision of science education and a global blind spot in science education as objective and without attending to social reality.

We focused specifically on the science curriculum in Ghana as opposed to other subjects such as history, geography, religious and moral and creative arts because; science education is exceptionally viewed by current and previous governments, stakeholders and policymakers in Ghana as a tool for national development (Ministry of Education, 2021). It occupies an important hierarchy in how policy makers view Ghana and largely Africa's development (Brown-Acquaye, 2004; Osseo-Asare, 2013; Tetteh et al., 2020). Recently, Ghana's Minister of Environment, Science and Technology asserted "Our agenda is simple. We want to use science and technology to develop so the plan is to make our society science and technology-minded" (Ministry of Environment, Science & Technology, 2021). This developmentalist or perhaps instrumentalist vision of science is unfortunate because it elides cultural, ethical and moral quagmires of the scientific enterprise as well as the challenges to biodiversity and the environment. The developmentalist vision is also neoliberal; partly responsible for the capitalist and globalist exploitation of natural resources and labour of people in the global south (Fremstad & Paul, 2022; Mikulewicz & Taylor, 2020).

The second reason for focusing on the science curriculum is because in a much broader conversation, science education, as compared to environmental education and the humanities and social sciences, has lagged in attending to sociological and cultural concerns (Hart, 2002; Lucas, 1980; Gough, 1993; Wals et al., 2014). There have been some attempts to expand the notion of science and science education to address social, cultural and economic realities and inequities. But we will argue that these efforts are mostly limited and inequities remain at multiple levels such as the lack of culturally relevant curriculum and instruction (Moura et al., 2023; Tovar-Gálvez, 2023; Robbins & Cipollone, 2023) and inadequate access to material resources by education researchers in the global South (Hassan et al., 2022). In many resource- scarce contexts, science curriculum materials are the main guide or the lens for classroom instruction suggesting a greater need for paying attention to the science curriculum (Barton, 2001; Boakye, 2015). Climate Change education presents an opportunity to create an interdisciplinary, multidisciplinary, transdisciplinary science curriculum.

We need climate change education in the science curriculum to be inclusive of globalisation, the socio-economic realities of people, power and politics, indigeneity and local ecologies and histories. We know, children have the capacity to engage with the complexities of knowledge and ideas when educators recognise and support student ideas and identities. This means, children in science classes are not passive recipients of information, but rather they interact and engage with that knowledge. As Apple (1992) observed "Students bring their own classed, raced, religious, and

gendered biographies with them as well. They, too, accept, reinterpret, and reject what counts as legitimate knowledge selectively” (p.5). Thus, the science of climate change needs to factor the lived realities of children into political and policy discourses in tackling climate change.

Coming to know: experiential and analytical

In this section, we discuss how we came to write this paper. We arrived at the underlying problem in this paper through five distinct and intersecting ways.

The novelist, Morgan (2017) observed “The formation of personality is inextricable from place. It strikes me as an interesting example of dependent co-arising; land shapes the organism, which then reshapes—literally and figuratively—the land” (p.1). Morgan’s observations apply to all the authors of this article. First, we are writing this paper having been shaped by Ghana’s land, soils, biodiversity, sea, cultural practices and its people. We believe our footprints have also shaped whatever landscapes we have tread in our lives. We have a spiritual and ethical connection to Ghana. Climate Change poses a threat to the rich and heterogeneous ecosystems and cultural services that have sustained us, Ghana and its people for generations.

Secondly, we are writing this paper from a position of relationality with our families and friends. As Tynan (2021), an indigenous scholar in Australia observed “Relationality is learnt from stories, watching our Old People yarn or sitting with Country – relationality is seldom learnt from academic journal articles” (p.1). As writers of this article, we are all part of different indigenous communities and families in Ghana. Through various informal and personal conversations and stories (Dinner table, Funerals, Naming Ceremonies) with family and friends, some of whom are parents and have children of school-going age, we have come to learn of their concerns for climate change education and broadly science education. They expressed the need for a sustainable education for their children and future generations. They want climate change education to empower their children. But at the same time, they recognise the larger global and political forces of capital and extraction shaping the world. They recognise that the current science curriculum lacks local and culturally relevant content or the curriculum falls short in addressing the lived realities of their children.

Thirdly, we came to this work through a reading of the published literature on climate change education. There is a paucity of scholarship on climate change education in Ghana (Appendix C). We used search engines such as ERIC, and African Education Research Database to locate studies on Ghanaian climate education as shown in Appendix C. We also conducted bibliographic and random Google searches and located works published about Ghana in the *Journal of Environmental Education*, *Environmental Education Research* and *Australian Journal of Environmental Education* (Appendix C). Our observation of the literature suggests that we need more studies on curriculum, instruction, evaluation and assessments and we need more locally affiliated Ghanaian researchers. We observed that a significant number of the studies were conducted by authors situated in Western institutions. The dominance of Western research means that other ways of being and existing in the world are relegated to the background. However, bringing into the academy bodies of work/literature from the global South expands and challenges our ideas about the purposes of schooling, educational policy and the human experience. The latter is particularly significant since climate change is not isolated to one country. Rather it affects people in different contexts, situations and geographies.

Fourth, we come to this work with decades of experience as teachers and educators in Ghana. We know; professional teaching experience is instrumental in how researchers frame the problem statement in their research (Kelsay, 1991). As former and current teachers in Ghana, we have first-hand knowledge of the workings of the curriculum and the educational system in Ghana. Collectively, we have about 15 years of experience teaching in Ghana and environmental outreach. At the moment, one of the authors is an active science teacher in Ghana implementing the

curriculum in their classroom. In our practice as teachers, we have observed the individualist framing of climate change that elides global capitalist systems. We acknowledge the technical emphasis on greenhouse gases.

Finally, we have come to this work through critical reading and reflection. Since the commissioning of Ghana's Science Curriculum in 2019 by the government of Ghana, we have met over the phone and zoom and talked about its content. Following a critical reading approach (Sobe, 2023), we have reviewed the climate change content as individuals and have met as a collective to discuss its contents, sort out its objectives and unpack its learning objectives and address the problems discussed in this paper.

Climate change content in Ghana's science curriculum

Before delving into the problems with Ghana's Climate Change Content, we provide below, a summary of the content of Ghana's climate change curriculum. Following our readings and reflections we observed; Climate Change Content in Ghana's Curriculum follows three broad framings and these are the Causes of Climate Change, the Impacts of Climate Change and Policy Solutions. The causes of climate change are attributed to human activity and the role of greenhouse gases are discussed in detail. The curriculum satisfies a lot of the correct and technical details about carbon emissions. The curriculum also presents broad framings of climate impacts. There is a particular focus on fisheries and agriculture. Rapid urbanisation and economic shifts are absent. The threat of climate change is duly recognised with generic allusions to humans and the environment. Finally, the curriculum recommends some policy solutions to deal with climate change. Concepts such as green economy, climate mitigation, climate adaptation and global citizenship are used to frame the policy solutions. But as we argue in the section below, these concepts are loosely connected, poorly discussed and, we argue that the Ghanaian Climate Change Content does not attend seriously to the global forces shaping the climate crisis. Because the curriculum is the basis on which textbooks and other learning materials are developed in Ghana, the curriculum content at the very least needs to be comprehensive and educative. To this end, we argue that the curriculum and documents used in teaching from Ghana should embrace the format of an "educative" curriculum. An educational curriculum designed to support teacher learning and knowledge (Schneider *et al.*, 2002; Davis *et al.*, 2017; Krajcik & Delen, 2017) by providing content, exercises and assessments that increase teachers' understanding and resourcefulness on any subject matter. Applying the concept of an educative curriculum to the curriculum from Ghana means, the curriculum should embody some affordances that deepen teacher knowledge about climate change.

The problem or gap

We note that Ghana's Climate Change content in primary and secondary school curricula follows the individualist paradigm of climate change education in the West. Here, Ghana's climate curriculum portrays a mostly westernised conception of climate change education. This follows that, Climate change education for school-age children in Ghana is presented as an imperative for raising a generation that is critical of *individual or personal environmental* behaviours, attentive to lifestyle choices and deeply committed to sustaining their communities and the earth (Cordero *et al.*, 2008; Henderson & Drewes, 2020; Monroe *et al.*, 2019; Reid, 2019). Suffice to say that the curriculum shifts the burden of proof about climate change to individual changes and pro-environmental behaviours rather than complex global systems. While the individualist or pro-environmental behavioural vision for climate change education is commendable and agentic in many ways, it shifts the responsibility from complex capitalist and global fossil fuel systems to individuals and impoverished communities. Ghana's science curriculum omits the economic contexts that surround the extraction and production of resources to meet global demand. This a

particularly glaring omission considering that the junior high school (JHS) science curriculum advocates for global citizenship. The JHS science curriculum also highlights the green economy in other countries and the need for global competencies. The word “global” appears on 17 pages of the 170-curriculum document (Appendix D), but it is loosely integrated into the content (National Council for Curriculum Assessment, 2019 & 2021). The curriculum settles for a global green economy instead of acknowledging the complex politics of natural resource extraction and capital that fuels climate change. And while an emphasis on a green economy is commendable, the text does not account for the ongoing struggle against the legacy of colonialism and governance in Ghana and the global South, and links to fossil fuel exploration (Bhambra, 2020; Daggett, 2021; Gonzalez, 2021). Speaking locally, Ghana, which has been a leader in climate change education, has made very little commitment towards climate mitigation policies that demand a shift away from fossil fuels. There is no existing national strategy to move away from a dependence on fossil fuels. Here, we would suggest that the concurrent/simultaneous climate change education strategy, on the one hand, and dependence on fossil fuels by Ghana, on the other hand, represents a major contradiction and must be acknowledged in the curriculum. Climate change education must contend with the complexities and tensions between capital and global needs, on one hand, and local people, on the other.

Recommendations and new directions

The Science curriculum on climate change needs to move beyond technical language about green economy and personal/individual behaviours to curbing greenhouse gases to an appraisal of climate change as part of a larger discourse on global power and politics. Otherwise, climate change education will be a blunt instrument for cultivating resilience among youth. This means the science curriculum and its emphasis on individual and community actions, cannot be decoupled from the global market forces of capital and production. Globalisation, in practice, has opened up vast channels of communication, knowledge exchange, cultural engagement and influences, and financial capital across borders and geographies in Ghana. And while aspects of these intercultural exchanges have supported development in Ghana, they also come with structural inequities and power imbalances particularly, for children and youth.

To build resilience for climate change among Ghanaian young people, children and youth in Ghana must be educated on the links between globalisation, local conditions and climate change policy. This will provide them with the tools to navigate the economic and social transformations brought on by the global and local impacts of climate change. And while “local” can be an important description of particular communities, the complex identities that underpin how countries in the global South are organised must be acknowledged when it comes to climate change adaptation as such understandings come with implications for children and youth. Here, the science curriculum should engage seriously with local histories and Indigenous Ghanaian languages and arts as part of a broader conceptualisation of Ghana’s place in the world. This means that the individual should be viewed as part of Ghanaian linguistic cultures and histories and aesthetics. This presents an opportunity to recontextualize some of the prevailing ideas about climate change and interrogate and reconstruct indigenous visions of a sustainable world and one that considers the peculiarities of Ghana’s ethnic composition and accompanying languages. To promote and teach Ghanaian Language and history and art in the context of climate change education means we need local and international support for Ghanaian language curricula, literary texts, cultural monographs, movies, documentaries, theatre production, art studios within the context of science and broadly environmental education. The broader point here is that cultures in the global South at least in the case of Ghana retain some originality or distinctiveness. However, at the same time, they are constantly in transition, changing and borrowing; these shifts cannot be attributed solely to Western domination (Gyekye, 2014). Applying the above arguments

to the climate change curriculum from Ghana, it is not the case that the West merely influences Ghana when it comes to climate change knowledge. Rather, Ghana and its people, despite our structural challenges, have exercised *agency* in recognizing that climate change is useful information/knowledge for future generations. Hence, we need an interdisciplinary science curriculum on climate change that integrates Ghanaian language, arts and histories. A significant number of countries in the global South such as Ghana have a history of colonisation and displacement of indigenous and native people. It is necessary to include these histories and their implications in climate change education, particularly concerning the distribution and use of physical resources such as land, water and minerals. A robust knowledge of the colonial enterprise is necessary for unravelling local and place-based environmental histories and remedies. Several scholars have noted the importance of place-based climate change education that contextualises the challenges at local scales (Littrell *et al.*, 2020; Rousell & Cutter-Mckenzie-Knowles, 2020; Bang, 2020; Hu & Chen, 2016). It is important to mention that the recognition and inclusion of a robust history and colonial past can be an empowering framework for children's education.

Despite some of the limitations discussed above, there are significant strengths in the curriculum such as the focus on technical details of the causes of climate change, emissions and greenhouse gases and the impacts of climate change such as drought. But as we pointed out in this paper, there is more work to be done.

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Ethical standard. Nothing to note.

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Appendix A. A table showing the subjects in which climate change is offered at the primary school in Ghana. The subjects are clustered according to the official curriculum released by the government

Subject	Primary 1–3	Primary 4–6
Mathematics	Climate Change Content is absent	Climate Change Content is absent
Science	Climate Change Content is Present (Treated as a topic)	Climate Change Content is Present (Treated as a topic)
English	Climate Change Content is present (Treated as an exemplar)	Climate Change Content is Present (Treated as an exemplar)
French	Subject is not offered at this grade level	Climate Change Content is absent
Computing	Subject is not offered at this grade level	Climate Change content is present (Treated as an exemplar)
Ghanaian Language	Climate Change Content is Present (Treated as an exemplar)	Climate Change Content is Present (Treated as an exemplar)
History	Climate Change content is absent	Climate Change Content is absent
Creative Arts	Climate Change Content is Present (Treated as an exemplar)	Climate Change Content is Present (Treated as an exemplar)
Our World and Our People	Climate Change Content is Present (Treated as an exemplar)	Climate Change Content is Present (Treated as a topic)
Physical Education	Climate Change Content is absent	Climate Change Content is absent
Religious & Moral Education	Climate Change Content is Present (Treated as an exemplar)	Climate Change Content is Present (Treated as an exemplar)

Appendix B. A table showing the subjects in which climate change is offered at the junior high school level in Ghana. From the table, the science curriculum is the main document for teaching climate change.

Subjects	Junior high school
Science	Climate Change Content is present (Treated as a topic)
Mathematics	Climate Change Content is absent
English	Climate Change Content is present (Treated as a suggested and supplementary reading)
Social Studies	Climate Change Content is absent
Arabic	Climate Change Content is absent
French	Climate Change Content is absent
Career Technology	Climate Change Content is Present (Treated as an exemplar)
Ghanaian language	Climate Change Content is absent
Computing	Climate Change Content is absent

(Continued)

(Continued)

Subjects	Junior high school
Physical Education	Climate Change Content is absent
Creative arts	Climate Change Content is Presented (Treated as an exemplar)
Religious and Moral Education	Climate Change Content is Presented (Treated as an exemplar)

Appendix C. A table showing Climate Change Education Research on Ghana from various Search Engines & Journals

Database	Search term	Results	Relevant results after review	Relevant papers after the review
ERIC	Climate Change Ghana	6	4	<ol style="list-style-type: none"> 1. Boakye, C. (2015). Climate change education: The role of pre-tertiary science curricula in Ghana. <i>Sage Open</i>, 5(4), 2158244015614611. 2. Nyarko, S., & Petcovic, H. (2022). Misconceptions about Climate Change and Ozone Depletion: Textbooks, Instructors and Media Influence on Ghanaian Pre-Service Teachers. <i>Authorea Preprints</i>. 3. Gebbels, S., Hunter, J., Nunoo, F. K., Tagoe, E., & Evans, S. M. (2012). Schoolchildren’s use of poetry and paintings in conveying environmental messages. <i>Journal of Biological Education</i>, 46(2), 93-102 4. Ress, S., Kendall, N., Friedson-Ridenour, S., & Ampofo, Y. O. (2022). Representations of Humans, Climate Change, and Environmental Degradation in School Textbooks in Ghana and Malawi. <i>Comparative Education Review</i>, 66(4), 599-619.
African Education Research Database	Climate change	4	2	<ol style="list-style-type: none"> 1. Boakye, C. (2015). Climate change education: The role of pre-tertiary science curricula in Ghana. <i>Sage Open</i>, 5(4), 2158244015614611. 2. Gebbels, S., Hunter, J., Nunoo, F. K., Tagoe, E., & Evans, S. M. (2012). Schoolchildren’s use of poetry and paintings in conveying environmental messages. <i>Journal of Biological Education</i>, 46(2), 93-102
Journal of Environmental Education	Climate Change Ghana	3	1	<ol style="list-style-type: none"> 1. Gladwin, D., Karsgaard, C., & Shultz, L. (2022). Collaborative learning on energy justice: International youth perspectives on energy literacy and climate justice. <i>The Journal of Environmental Education</i>, 53(5), 251-260.
Environmental Education Research	Climate Change Ghana	7	1	<ol style="list-style-type: none"> 1. Witoszek, N. (2018). Teaching sustainability in Norway, China and Ghana: challenges to the UN programme. <i>Environmental Education Research</i>, 24(6), 831-844.
Auxiliary Finding				<ol style="list-style-type: none"> 1. Acharibasam, J. B., & McVittie, J. (2022). Connecting children to nature through the integration of Indigenous Ecological Knowledge into Early Childhood Environmental Education. <i>Australian Journal of Environmental Education</i>, 1-13. 2. Owolabi, H. O., Gyimah, E. K., & Amponsah, M. O. (2012). Assessment of junior high school students’ awareness of climate change and sustainable development in central region, Ghana.

Appendix D. A table showing aspects of Ghana's junior high science curriculum with references to green economy (p. 120). Source: Ministry of Education (2021).

STRAND 5: HUMANS AND THE ENVIRONMENT.

SUB-STRAND 4: CLIMATE CHANGE AND GREEN ECONOMY.

Content standard	Indicators and exemplars	Core competencies
B9/JHS3.5.4.1 Demonstrate an understanding of the natural and human factors that influence climate change and a green economy	B9/JHS3.5.4.1.1 Examine various natural and human factors that influence climate change and green economy in their localities. Exemplars: 1. Identify the natural factors that influence climate change. 2. Describe ways of minimising human activities that influence climate change. 3. Compare natural and human factors that influence climate change and green economy.	Communication and Collaboration (CC), Creativity and Innovation (CI), Digital Literacy (DL), DL 6.4: Adhere to behavioural protocols that prevail in cyberspace CC 7.5: Identify and analyse different points of views of speaker CI 6.3: Ability to select the most effective creative tools for work and give reasons for the choice
B9/JHS3.5.4.2 Evaluate the effectiveness of initiatives that address the issue of climate change and green economy in Ghana and the world at large	B9/JHS3.5.4.2.1 Assess data on climate change and green economy actions/ activities globally including Ghana and other countries. Exemplars: 1. Research into climate change and green economy actions in Ghana. 2. Access climate change and green economy actions in other countries. 3. Compare and contrast climate change and green economy actions in Ghana and other countries. 4. Identify and write the effective initiatives that address climate change and green economy issues in Ghana and other countries.	Critical Thinking and Problem Solving (CP), Digital Literacy (DL) CP 6.3: Identify important and appropriate alternatives DL 5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem CP 6.4: Ability to identify important and appropriate criteria and use them to evaluate alternatives CP 6.3: Ability to select alternative(s) that adequately meet selected criteria CP 5.1: Ability to combine information

Author Biographies

Christian Konadu Asante was born and raised in Ghana and where he received a bachelor's degree in Zoology. He has a master's in Environment and Sustainability from the University of Saskatchewan in Canada and a PhD in Curriculum and Instruction from Boston College, Massachusetts. His PhD thesis focused on cross cultural climate change education in Bangladesh, Ghana and the United States. He has over a decade of teaching and outreach experience in Ghana, Canada and the United States. He is currently an assistant professor in Environmental Science Education at California State University, Chico.

Edward Yalley is currently in a Ph.D. (Curriculum and Instruction-Mathematics Education) programme at Louisiana State University, Baton Rouge. In August 2012, he was posted to teach at Asamama Presbyterian Basic School in the Ashanti Region of Ghana as a National Service Personnel. In Asamama Presby, he taught Integrated Science, Religious and Moral Education, English, Mathematics and Information Communication Technology at the early grade level. He taught mathematics for five years (2016 to 2022) at Daffiama Senior High School in the Upper West Region of Ghana.

Gideon Amissah is currently the assistant head of academics at Deborah Vision School in Amasaman, Ghana. He teaches Junior High School Mathematics and Science. He has about 8 years as a secondary school teacher in Ghana. Before teaching, he was with the Kakum National Park where he worked to educate farmers and build alliances to address human-wildlife conflict. He received a bachelor's degree in Zoology from the University of Ghana.

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