Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.16, No.3, 2025

Assessing the Integration of Sustainable Development Goal 13(Climate Action) in Ghana's Standards-Based Curriculum

Edmond Ahovi
https://orcid.org/0009-0006-7468-5323
Department of Educational Foundation, University of Education, Winneba.
*E-mail of the corresponding author: edmondahovi8@gmail.com

Abstract

This study examines the extent to which Sustainable Development Goal 13 (Climate Action) is integrated into Ghana's Standards-Based Curriculum (SBC), launched in 2019. Using content analysis, the study systematically reviews curriculum documents across ten subjects to identify explicit and implicit references to SDG 13 themes, such as climate change mitigation, adaptation, and environmental resilience. The findings reveal an uneven distribution of climate action concepts, with subjects like English and Our World Our People (OWOP) showing moderate integration, while Mathematics, Computing, and History exhibit no mention of SDG 13. The study highlights the lack of intentional integration of climate action in the SBC, despite Ghana's vulnerability to climate change impacts such as rising temperatures, erratic rainfall, and coastal erosion. The results underscore the need for curriculum reform to align with global sustainability priorities and equip students with the knowledge and skills to address climate challenges. Recommendations include enhancing teacher training, incorporating SDG 13 across all subjects, and fostering interdisciplinary collaboration to promote climate action education. This study contributes to the growing body of literature on SDG integration in education systems, particularly in developing countries, and offers actionable insights for policymakers and educators in Ghana and beyond.

Keywords: Sustainable Development Goal, Standards-Based Curriculum, Ghana, Climate Action

DOI: 10.7176/JEP/16-3-03
Publication date: March 30th 2025

1. Introduction

Sustainable Development Goal 13 (SDG 13) was established by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development, with a specific focus on combating climate change and mitigating its impacts. Recognizing climate change as one of the most pressing global challenges, SDG 13 aims to promote urgent actions to reduce greenhouse gas emissions, build resilience to climate-related disasters, and integrate climate policies into national frameworks.

The global rise in temperatures, caused primarily by human activities such as deforestation and the burning of fossil fuels, has led to more frequent and severe natural disasters, including droughts, floods, and storms. These events disproportionately affect vulnerable communities, particularly in developing countries. SDG 13 emphasizes the need for developed nations to fulfill their commitment to mobilize financial resources and support developing countries in addressing the impacts of climate change. Key targets of the SDG 13 (climate action) include:

- Strengthening resilience and adaptive capacity: Countries are encouraged to build the infrastructure and systems necessary to withstand climate-related hazards, such as floods, storms, and droughts.
- Integrating climate change measures into policies and planning: Governments must mainstream climate change adaptation and mitigation into national strategies, ensuring long-term sustainability.
- Education and awareness: Expanding education and public awareness on climate change is essential to fostering a global culture of sustainability.
- International cooperation and financial commitment: Developed countries are tasked with mobilizing $100 billion annually by 2020 to support climate initiatives in developing nations, particularly for mitigation and adaptation efforts.
- Promoting mechanisms for climate-related planning in least developed countries: These mechanisms aim to help vulnerable countries build the capacity for sustainable planning and management of climate change impacts.

SDG 13 is closely linked to several other Sustainable Development Goals, as climate change impacts sectors

such as health (SDG 3), water (SDG 6), and biodiversity (SDG 15). Without immediate and concerted action, climate change will continue to exacerbate existing global inequalities and pose a significant threat to achieving sustainable developmen

The Standards-Based Curriculum (SBC) of Ghana, launched in 2019 by the Ministry of Education, seeks to transform basic education by focusing on competency-based learning. Designed for kindergarten to primary education, it aims to foster critical thinking, problem-solving, creativity, and collaboration among learners. Shifting from rote memorization, the SBC emphasizes practical skill acquisition, continuous assessment, and learner-centered methodologies. Additionally, it promotes holistic development by integrating moral and social values, with a strong emphasis on teacher training and professional development to ensure effective implementation.

Key features include:

- Learner-Centered Approach: Active learning is prioritized, encouraging students to engage in inquiry-based education.
- Competency-Based Learning: The focus is on building essential competencies such as critical thinking, problem-solving, creativity, and communication, aimed at preparing students for real-world challenges.
- Holistic Development: The SBC goes beyond academic instruction, incorporating moral, social, and emotional growth, fostering well-rounded individuals.
- Continuous Assessment: Emphasizing formative over summative assessment allows teachers to track student progress and address learning gaps continuously.
- Teacher Training and Professional Development: To ensure effective curriculum delivery, teachers receive extensive training on competency-based methodologies, backed by continuous professional support.
- Integration of Indigenous Knowledge and Values: The SBC emphasizes the inclusion of Ghanaian cultural values, local knowledge, and indigenous practices, encouraging the development students' understanding of their heritage while aligning with global educational standards.

Overall, the SBC was designed to meet both local and global educational demands, preparing students to thrive in a rapidly changing world. By focusing on active learning, practical skills, and the holistic development of learners, the curriculum ensures that education in Ghana is both relevant and future-ready. Ghana's 2019 Standards-Based Curriculum (SBC) marks a significant shift toward competency-based education, emphasizing critical thinking, creativity, and problem-solving. However, it has been criticized for its lack of intentional integration of the Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action). Although the curriculum was launched in 2019, four years after the launch of the Sustainable development goals, the SDG 13 (climate action) which is a global worry affecting many nations was not largely incorporated into the curriculum. This oversight is concerning given Ghana's increasing vulnerability to climate change impacts, such as rising temperatures, erratic rainfall, and coastal erosion (Environmental Protection Agency, 2020). While the SBC includes some implicit references to environmental sustainability, these are often incidental rather than systematic, leading to fragmented and inconsistent coverage of climate action themes. For instance, Science lessons touch on environmental science but fail to explicitly link these topics to SDG 13 or global climate frameworks (Kagawa & Selby, 2010). Subjects like Mathematics, Computing, and Physical Education show no mention of climate-related concepts, which limits the holistic integration of SDG 13 across the curriculum (Brundiers et al., 2021).

The SBC aims to balance local cultural values with global educational standards, but the lack of intentional integration of the SDGs undermines its global relevance. By not embedding the SDGs, particularly SDG 13, the curriculum fails to prepare students to contribute to global sustainability efforts while addressing local environmental challenges. Ghana, as a developing country, is highly vulnerable to climate change impacts, such as food insecurity, water scarcity, and displacement due to rising sea levels (Intergovernmental Panel on Climate Change, IPCC, 2021). The curriculum's failure to prioritize climate action education leaves students ill-prepared to tackle these challenges. Even if the curriculum were to include more explicit references to SDG 13, there is a lack of evidence that teachers are adequately trained to deliver these concepts effectively. Teacher training programs in Ghana often focus on pedagogical skills rather than content-specific knowledge, such as climate change education (Monroe et al., 2017). This gap further limits the potential impact of any implicit SDG-related content in the curriculum. The uneven distribution of SDG 13 concepts across subjects high in English and Our World Our People (OWOP) but absent in Mathematics and History, suggests a lack of a cohesive strategy for integrating climate action into the curriculum (Anderson, 2012). This inconsistency may lead to gaps in students' understanding of climate change and sustainability.

The United Nations' 2030 Agenda for Sustainable Development, adopted in 2015, emphasizes the critical role of education in achieving the SDGs (United Nations, 2015). SDG 4 (Quality Education) explicitly calls for education systems to promote sustainable development and global citizenship, while SDG 13 (Climate Action) highlights the need for education and awareness-raising on climate change mitigation and adaptation (UNESCO, 2017). Education is widely recognized as a key driver for achieving the SDGs, as it equips individuals with the knowledge, skills, and attitudes needed to address global challenges. Developing countries, particularly in sub-Saharan Africa, are among the most vulnerable to the impacts of climate change due to their reliance on climate-sensitive sectors such as agriculture and limited adaptive capacity (IPCC, 2021). Education systems in these regions play a crucial role in building resilience and fostering sustainable development. However, many developing countries, including Ghana, face challenges in integrating climate change education into their curricula due to resource constraints, lack of teacher training, and competing educational priorities (Tilbury, 2011).

Ghana's National Climate Change Policy emphasizes the importance of education in building resilience and promoting sustainable development (Ministry of Environment, Science, Technology, and Innovation, Ghana, 2013). However, the integration of climate change education into the national curriculum remains limited, despite the urgency of the issue. A curriculum that intentionally integrates climate action can empower students to understand the causes and consequences of climate change, develop solutions, and take proactive measures to mitigate its impacts. However, the effectiveness of such integration depends on the curriculum's design, teacher preparedness, and the availability of relevant teaching materials (Anderson, 2012). In Ghana, the 2019 SBC represents a shift toward competency-based education but falls short in explicitly addressing climate action, despite its potential to foster sustainability and resilience.

Studies have shown that the intentional integration of the SDGs into national curricula can enhance students' understanding of global challenges and their role in addressing them (Brundiers et al., 2021). For example, countries like Finland and Sweden have successfully embedded sustainability education into their curricula, resulting in increased student awareness and engagement with environmental issues (Borg et al., 2014). In contrast, many developing countries, including Ghana, lag behind in this regard, often due to systemic challenges such as limited resources and competing educational priorities (Tilbury, 2011). While there is a growing body of literature on the integration of the SDGs into education systems, there is limited research on how developing countries, particularly in sub-Saharan Africa, are addressing this challenge. Specifically, there is a lack of studies examining the extent to which Ghana's 2019 SBC incorporates SDG 13 and other sustainability-related goals. This study seeks to fill this gap by assessing the pervasiveness of SDG 13 in the SBC and providing recommendations for its intentional integration.

Objectives of the study

1. To know the extent to which the Sustainable development goal 13 (climate action) is represented in the Ghanaian Standard based curriculum

Literature Review

The integration of Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action), into education systems has been the focus of several studies, each contributing valuable insights into the challenges and opportunities of embedding sustainability into curricula. A 2023 study by Helldén et al. analyzed 37 Sharing Information on Progress (SIP) reports from business schools and higher education institutions (HEIs) globally, using qualitative content analysis to explore how SDGs are integrated into teaching, research, and partnerships. The study found that HEIs are increasingly incorporating SDGs through new courses, modules, and interdisciplinary collaborations, though integration is uneven, with some institutions excelling while others lag behind. Partnerships between HEIs, governments, and NGOs were identified as crucial for effective SDG integration. However, the study relied heavily on self-reported data from Sharing Information on Progress (SIP) reports, which may lack objectivity, and did not explore challenges in low-resource settings, such as sub-Saharan Africa. The current study on Ghana's Standards-Based Curriculum (SBC) addresses this gap by providing a localized perspective on SDG integration in a developing country context, using a mixed-methods approach that combines content analysis with teacher interviews to offer a more comprehensive understanding of the challenges and opportunities for SDG integration.

In 2024, Albareda-Tiana et al. conducted a study in Spain to assess the effectiveness of active teaching methodologies, such as problem-oriented learning and case studies, in integrating SDGs into university curricula. Using a mixed-methods approach that included surveys, focus groups, and classroom observations, the study found that active methodologies significantly enhanced students' sustainability competencies. However, challenges included coordinating interdisciplinary projects among students from different programs. The study's focus on Spanish universities limits its generalizability to other contexts, particularly in developing countries

where resource constraints may hinder the implementation of active methodologies. The current study explores the feasibility of active methodologies in Ghana's SBC, considering the resource limitations and cultural context of the country, and provides recommendations for adapting these methodologies to low-resource settings.

A 2021 study by Caputo et al. investigated the contribution of HEIs to the SDGs through sustainability reporting practices, using bibliometric analysis, case studies, and surveys to assess student engagement. The study found that students who had taken courses related to SDGs were more likely to engage in sustainability initiatives, with graduate students showing higher familiarity with SDGs compared to undergraduates. Barriers to engagement included lack of awareness and institutional support. However, the study did not delve into the specific challenges faced by students in developing countries, where access to SDG-related courses and resources may be limited. The current study focuses on Ghanaian students, exploring their awareness of SDG 13 and the extent to which the SBC prepares them to address climate change, while also examining the role of teacher training in enhancing student engagement with SDGs.

In 2019, Mawonde and Togo conducted a case study in Japan to examine SDG education in depopulated regions, focusing on the Tohoku area. Using qualitative methods such as interviews and focus groups, the study found that localized SDG education, tailored to regional characteristics, was effective in fostering community resilience and sustainability. Linking global SDG frameworks with local contexts was identified as crucial for success. However, the study's focus on a single region limits its generalizability to other contexts, particularly urban areas or regions with different demographic challenges. The current study explores how Ghana's SBC can integrate global SDG frameworks with local cultural values and environmental challenges, providing a model for other developing countries.

A 2022 study by Leal Filho et al. explored the use of gamification to foster critical thinking and SDG awareness among young people. Using pre- and post-activity surveys, the study found that gamification significantly increased students' engagement with SDG-related topics. However, students were less likely to verify information related to collective environmental issues, such as climate change, compared to individual health topics. The study's focus on European students limits its applicability to other regions, particularly where access to digital tools for gamification may be limited. The current study explores alternative methods for engaging students with SDG 13 in low-resource settings, such as community-based projects and local case studies.

Finally, a 2021 study by Akari Software reviewed multiple case studies of SDG integration into curriculum design and research at HEIs, proposing a three-step framework for SDG integration: mapping existing contributions, identifying gaps, and aligning teaching and research activities with SDG targets. The study found that universities that adopted a systematic mapping strategy were more successful in integrating SDGs into their curricula, with interdisciplinary collaboration being essential for effective SDG integration. Challenges included lack of awareness, resource constraints, and resistance to change. However, the study's focus on HEIs limits its applicability to primary and secondary education systems, where SDG integration may require different strategies. The current study focuses on Ghana's SBC, providing a detailed analysis of SDG integration in primary and secondary education and proposing a framework for continuous curriculum review and improvement.

The integration of Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action), into education systems is critical for equipping future generations with the knowledge, skills, and attitudes needed to address pressing global challenges like climate change. While existing studies have provided valuable insights into how SDGs are being incorporated into curricula, particularly in higher education, significant gaps remain. These include a lack of focus on primary and secondary education systems, limited attention to developing country contexts, and insufficient exploration of localized approaches to SDG integration.

Ghana's 2019 Standards-Based Curriculum (SBC) represents a significant shift toward competency-based education, yet its intentional integration of SDG 13 remains understudied. Given Ghana's vulnerability to climate change impacts, such as rising temperatures, erratic rainfall, and coastal erosion, it is imperative to assess how effectively the SBC prepares students to address these challenges. By conducting a content analysis of the SBC, this study seeks to fill these gaps, providing a localized perspective on SDG integration in a developing country context. The findings will not only contribute to the global discourse on SDG integration in education but also offer actionable recommendations for curriculum reform in Ghana and beyond, ensuring that education systems are aligned with both local and global sustainability priorities. In a world increasingly threatened by climate change, this study is a necessary step toward fostering a generation of learners who are equipped to take meaningful action for a sustainable future.

Methodology

In order to find the prevalence of the SDG 13 in the Ghanaian standard-based curriculum, Content Analysis was used as the main methodology to assess the integration of SDG 13 concepts in the Standards-Based Curriculum

(SBC). This approach was chosen for its effectiveness in systematically analyzing textual data and identifying patterns and themes related to climate change. The analysis involved systematically reviewing curriculum documents across all subjects and grade levels at the basic school. The learning objectives for SDG 13 as cited in Education for Sustainable Development: learning objectives (2017, p.36) were used for the mapping worksheet for the analysis of the various subjects under the Standards-based curriculum. The SDG 13(climate action) has 15 learning objectives in which the mapping and content analysis was done against. Climate-related concepts such as climate change, sustainability, and environmental resilience were identified and catalogued, references were also classified into SDG 13-related themes (e.g., mitigation, adaptation). Finally, the frequency and depth of climate content across grade levels and subjects were measured in order to get results. This approach helped determine the extent of SDG 13 topics within the SBC, providing insights into how effectively the curriculum addresses climate action.

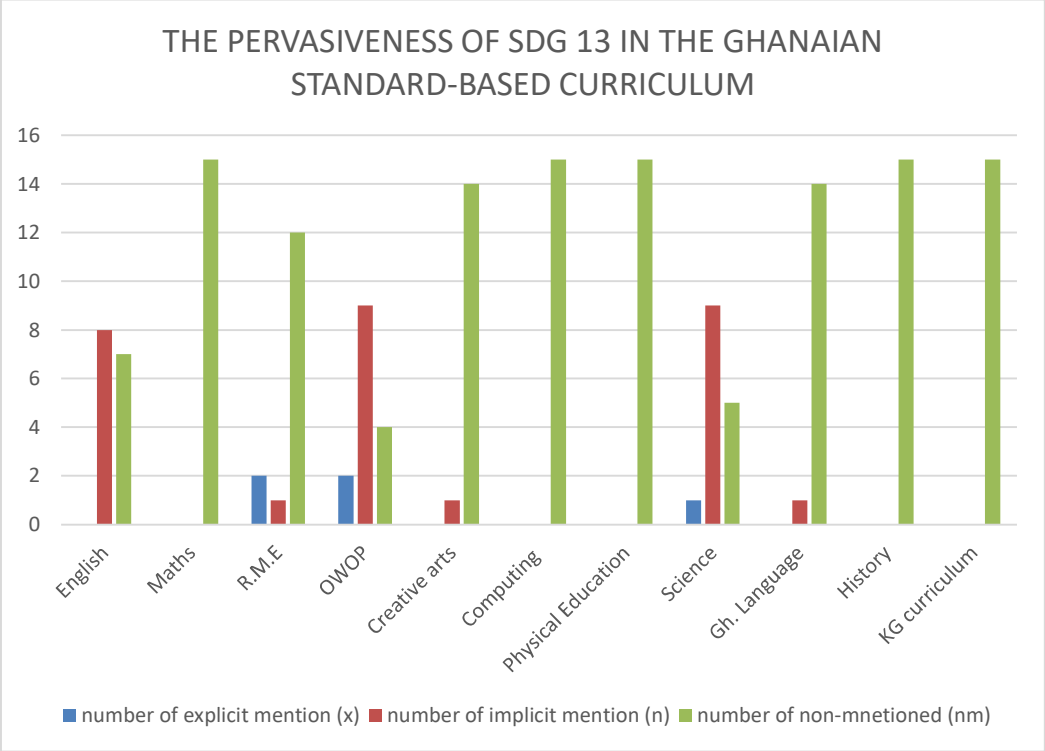
Results and Discussion

Table 1: *Descriptive analyses table of the findings on the pervasiveness of SDG 13 in the Ghanaian Standard-Based curriculum*

curriculum subjects	**number of explicit mention (x)**	**number of implicit mention (n)**	**number of non-mentioned (nm)**
English		8	7
Maths			15
Religious and Moral Education (R.M.E)	2	1	12
Our World Our People (OWOP)	2	9	4
Creative arts		1	14
Computing			15
Physical Education			15
Science	1	9	5
Ghanaian Language		1	14
History			15
KG curriculum	0	0	15

Content analysis report

Figure 1: *graphical representation of the table*



The finding from the table and the graphical representation details how SDG 13 (Climate Action) is represented across various subjects in the Standards-Based Curriculum. Each subject's curriculum is analyzed for the number of explicit mentions (x), implicit mentions (n), and non-mentions (nm) of SDG 13 concepts.

Detailed report of the Analysis

1. English

Explicit Mention (x): 0

There are zero explicit references to SDG 13 in the English curriculum. This means that there were no mentions in the curriculum that was directly linked with the SDG 13 themes

Implicit Mention (n): 8

There are eight instances where SDG 13 is indirectly referenced. This is through the discussion of literary themes, vocabulary exercises, or comprehension passages that touch on climate, environmental protection, or sustainability without overtly mentioning SDG 13 and its related themes.

Non-Mentioned (nm): 7

There were seven instances where the themes in the SDG 13 were not mentioned in the English curriculum

2. Mathematics

Explicit Mention (x): 0

SDG 13 is not explicitly mentioned in the mathematics curriculum. The curriculum likely does not address climate action directly, as the subject focuses more on numerical and abstract concepts.

Implicit Mention (n): 0

There are no implicit references to SDG 13 either, suggesting that Mathematics, in this curriculum, is not linked to discussions of climate or sustainability.

Non-Mentioned (nm): 15

All aspects of the mathematics curriculum (15 segments) do not mention SDG 13. This could indicate that the

curriculum does not incorporate real-world examples related to climate action in its lessons.

3. Religious and Moral Education (R.M.E.)

Explicit Mention (x): 2

Two explicit mentions of SDG 13 are found in the R.M.E. curriculum, this is through lessons on moral responsibility towards environmental care or discussions on sustainable use of the environment and activities that destroy the environment

Implicit Mention (n): 1

There is one implicit mention, which relate to teachings on moral duties toward protecting the Earth or sustainable living, aligning with religious and ethical principles.

Non-Mentioned (nm): 12

Twelve parts of the curriculum do not mention SDG 13 and its related themes, indicating limited integration of climate action themes in R.M.E.

4. Our World Our People (OWOP)

Explicit Mention (x): 2

Two explicit mentions of SDG 13 and its related themes are present in lessons dealing with environmental degradation and community activities that address climate action.

Implicit Mention (n): 9

Nine implicit mentions suggest that climate-related concepts are covered through broader discussions on human interaction with the environment, sustainable development, and community well-being.

Non-Mentioned (nm): 4

Four parts of the OWOP curriculum do not mention SDG 13, indicating that most of the curriculum addresses relevant topics, but some aspects are unrelated to climate action.

5. Creative Arts

Explicit Mention (x): 0

No explicit mentions of SDG 13 in the Creative Arts curriculum. This suggests that the subject does not directly focus on climate action or environmental themes in its core teachings.

Implicit Mention (n): 1

There is one implicit mention, this is through artistic expression related to nature, environmental conservation, or sustainable art projects.

Non-Mentioned (nm): 14

Fourteen sections of the Creative Arts curriculum do not mention SDG 13. This indicates that climate action is generally not a focus within this subject.

6. Computing

Explicit Mention (x): 0

There are no explicit mentions of SDG 13 in the Computing curriculum. The focus here is likely on technical skills rather than climate action.

Implicit Mention (n): 0

No implicit references are present, suggesting that the curriculum does not incorporate SDG 13 concepts, even in indirect ways.

Non-Mentioned (nm): 15

All 15 sections of the Computing curriculum do not mention SDG 13, indicating no connection between computing and climate action in this subject.

7. Physical Education (PE)

Explicit Mention (x): 0

No explicit mentions of SDG 13 in the PE curriculum. Physical education typically focuses on health, fitness, and well-being, so direct discussions on climate action are not present.

Implicit Mention (n): 0

No indirect mentions of SDG 13, further confirming that PE does not incorporate climate-related concepts.

Non-Mentioned (nm): 15

All 15 sections of the PE curriculum do not mention SDG 13, suggesting that the subject is not linked to climate action topics.

8. Science

Explicit Mention (x): 1

SDG 13 is explicitly mentioned once in the Science curriculum. This relate to discussions on environmental science, climate change, or ecosystem preservation.

Implicit Mention (n): 9

Nine implicit mentions suggest that climate action themes are discussed indirectly, through topics such as the impact of human activities on the environment, sustainable practices, or ecological balance.

Non-Mentioned (nm): 5

Five parts of the Science curriculum do not mention SDG 13 or its related themes, but overall, the subject integrates climate action themes in several sections.

9. Ghanaian Language

Explicit Mention (x): 0

There are no explicit mentions of SDG 13, suggesting that climate-related concepts are not widely integrated into the subject

Implicit Mention (n): 1

SDG 13 is explicitly mentioned once in the Ghanaian Language curriculum, through texts or discussions that touch on environmental preservation in local contexts

Non-Mentioned (nm): 14

Fourteen sections of the curriculum do not mention SDG 13 or its related themes, indicating limited integration of climate action themes.

10. History

Explicit Mention (x): 0

No explicit mentions of SDG 13 in the History curriculum. History tends to focus more on past events, people, and movements, with little attention to current global goals like climate action.

Implicit Mention (n): 0

No implicit mentions either, suggesting that climate-related topics are not indirectly addressed in the subject.

Non-Mentioned (nm): 15

All 15 parts of the History curriculum omit SDG 13, showing no incorporation of climate action concepts

Summary of SDG 13 Integration Across Subjects

High Representation: Subjects like English and OWOP showed strong integration of SDG 13 concepts, both

explicitly and implicitly.

Moderate Representation: Subjects such as R.M.E. and Science included some discussions on climate action, though they were more implicit.

Low to No Representation: Subjects like Mathematics, Computing, PE, and History showed no mention of SDG 13, indicating that these subjects do not directly engage with climate-related topics.

This analysis highlights the uneven distribution of climate action concepts across the curriculum, with some subjects more actively addressing SDG 13 than others.

Conclusion and Recommendation

Conclusion

The study reveals that Ghana's Standards-Based Curriculum (SBC) lacks intentional and systematic integration of Sustainable Development Goal 13 (Climate Action). While some subjects, such as English, Our World Our People (OWOP), and Science, include implicit references to climate-related themes, others like Mathematics, Computing, and History show no mention of SDG 13. This uneven distribution of climate action concepts undermines the curriculum's potential to prepare students to address the urgent challenges posed by climate change. Given Ghana's vulnerability to climate impacts, such as food insecurity, water scarcity, and coastal erosion, the absence of explicit climate action education in the SBC is a significant oversight. Furthermore, the study highlights the critical role of teacher training in delivering climate-related content effectively. Without adequate preparation, even implicit references to SDG 13 may fail to achieve their intended impact. The findings underscore the need for curriculum reform to align with global sustainability priorities and foster a generation of learners equipped to tackle climate challenges.

Recommendations

1. Educational authorities like the ministry of education together with the ghana education service should Integrate SDG 13 explicitly across all subjects, ensuring a cohesive and comprehensive approach to climate action education.
2. The government should develop interdisciplinary modules that connect climate action with local and global contexts, fostering a deeper understanding of sustainability.
3. There should be targeted training for teachers on climate change education, equipping them with the knowledge and skills to deliver SDG 13 content effectively.
4. Climate action should be incorporated into teacher training programs, emphasizing active learning methodologies and real-world applications.
5. Resources should be allocated for the development of teaching materials and tools that support climate action education, such as case studies, simulations, and community-based projects.
6. The SBC should be aligned with Ghana's National Climate Change Policy and the United Nations' 2030 Agenda for Sustainable Development, ensuring that climate action is a priority in national education strategies.
7. Establish a framework for continuous curriculum review and improvement, incorporating feedback from educators, students, and policymakers.
8. Partnerships should be fostered between schools, local communities, and NGOs to promote climate action initiatives and enhance student engagement with sustainability issues.
9. Encourage student-led projects that address local climate challenges, fostering a sense of agency and responsibility.

By implementing these recommendations, Ghana can transform its education system into a powerful tool for promoting climate action and sustainable development, ensuring that future generations are equipped to address the pressing challenges of a changing world.

References

Akari Software. (2021). Integrating SDGs into curriculum design and research. *Journal of Sustainability in Higher Education.*

Albareda-Tiana, S., Fernandez-Borsot, G., Berbegal-Mirabent, J., Regadera González, E., Mas-Machuca, M., Graell, M., Manresa, A., Fernández-Morilla, M., Fuertes-Camacho, M. T., Gutiérrez-Sierra, A., & Guardiola, J. M. (2024). Enhancing curricular integration of the SDGs: Fostering active methodologies through cross-departmental collaboration in a Spanish university. *International Journal of Sustainability in Higher Education*, 25(5), 1024–1047. https://doi.org/10.1108/IJSHE-07-2023-0299

Anderson, A. (2012). Climate change education for mitigation and adaptation. *Journal of Education for Sustainable Development*, 6(2), 191–206. https://doi.org/10.1177/0973408212475199

Borg, C., Gericke, N., Höglund, H., & Bergman, E. (2014). Subject- and experience-bound differences in teachers' conceptual understanding of sustainable development. *Environmental Education Research*, 20(4), 526–551. https://doi.org/10.1080/13504622.2013.833584

Brundiers, K., Barth, M., Cebrián, G., Cohen, M., Diaz, L., & Thomas, I. (2021). Key competencies in sustainability in higher education—Toward an agreed-upon reference framework. *Sustainability Science*, 16, 13–29. https://doi.org/10.1007/s11625-020-00838-2

Caputo, F., Ligorio, L., & Pizzi, S. (2021). The contribution of higher education institutions to the SDGs—An evaluation of sustainability reporting practices. *Administrative Sciences*, 11(3), 97. https://doi.org/10.3390/admsci11030097

Environmental Protection Agency (EPA) Ghana. (2020). *Ghana's Third National Communication to the UNFCCC*. https://unfccc.int

Helldén, D., Alfvén, T., Niemi, M., Leander, K., Nordenstedt, H., Ndejjo, R., Wanyenze, R. K., & Biermann, O. (2023). Integrating the United Nations sustainable development goals into higher education globally: A scoping review. *Global Health Action*, 16(1), 2190649. https://doi.org/10.1080/16549716.2023.2190649

Intergovernmental Panel on Climate Change (IPCC). (2021). Climate Change 2021: *The Physical Science Basis.* Cambridge University Press. https://www.ipcc.ch/report/ar6/wg1/

Kagawa, F., & Selby, D. (2010). *Education and climate change: Living and learning in interesting times.* Routledge.

Leal Filho, W., et al. (2022). *Governance and leadership in guiding sustainability initiatives at higher education institutions Sustainability*, 14(3), 1234. https://doi.org/10.3390/su14031234

Mawonde, A., & Togo, M. (2019). Implementation of SDGs at the University of South Africa. *International Journal of Sustainability in Higher Education,* 20(5), 932–950. https://doi.org/10.1108/IJSHE-05-2018-0087

Ministry of Education, Ghana. (2019). *Standards-Based Curriculum for Basic Schools*. https://moe.gov.gh

Ministry of Environment, Science, Technology, and Innovation, Ghana. (2013*). National Climate Change Policy*. https://www.epa.gov.gh

Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2017). Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research*, 25(6), 791–812. https://doi.org/10.1080/13504622.2017.1360842

Tilbury, D. (2011). *Education for sustainable development: An expert review of processes and learning*. UNESCO. https://unesdoc.unesco.org

UNESCO. (2017). *Education for Sustainable Development Goals: Learning Objectives*. https://unesdoc.unesco.org

United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. https://sdgs.un.org/2030agenda