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Anchoring Climate Change in the Ongoing Educational Reforms in Kenya

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Abstract
The entire globe is mobilizing around climate change issues while being driven by a pressing desire to take action to understand its causes and effects and to mitigate its impact. Education has been identified as one among the key interventions, motivated by the belief that it can bring about fundamental mindset shifts in not only addressing the causes but also adapting and coping with the unavoidable effects of climate change. There is, therefore, need to make the curricula of schools more responsive to climate change by integrating aspects of climate and environment, which include among others, its concepts, greenhouse emissions, protection measures and support for individual and societal climate change resilience. Kenya has been undertaking reforms in the education sector with a shift from the knowledge-based to competency-based curriculum since 2017. To what extent has the new curriculum integrated aspects of environment, climate and climate change? This paper used the existing documentary evidence to analyse the extent to which the aspects have been integrated in the curriculum for pre-primary (PP 1-2) and primary schools (Grades 1-6). It is expected that the paper will inform the curriculum review process in Kenya on the critical role of environmental education as a tool for combating climate change.

Keywords: Climate change, climate change resilience, curriculum review, educational reforms, environmental education

Introduction

Climate change is the long-term alteration in the earth's climate and weather patterns. It is mainly caused by greenhouse gases emitted in the atmosphere as a result of human activity. Carbon IV Oxide (CO2) has the greatest effect which according to scientists, if its levels in the atmosphere are doubled, global temperatures would increase by about 5 (five) degrees (History.Com Editors, 2022). Climate change threatens to undo and even reverse the progress made towards meeting the Sustainable Development Goals (SDGs) and poses as one of the most serious challenges to achieving sustainable development for the international community (Walter et al., 2021).

According to the United Nations International Panel on Climate Change (UNIPCC), the continued changing climate will have widespread effects on human life and ecosystems (Intergovernmental Panel on Climate Change, 2012). Muchangi (2022) notes that African countries, especially in Sub-Sahara are already struggling to adapt to the reality of a changing climate. A study carried out by the Save the Child Organization in 2021 showed that the Kenyan child born in the year 2020 and after, will on average, face 4.6 times more droughts during their lives than their grandparents.

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Kenya is a leader in addressing climate change. It was one of the first African countries to enact a comprehensive law and policy to guide national and subnational (county) climate action. The Climate Change Act of 2016 and the National Climate Change Action Plans (NCCAP) 2013-2017 and 2018-2022 provide guidance for low carbon and climate resilient development (USAID, 2022). According to USAID, the Country's priorities as articulated through these documents include; adaptation, afforestation and reforestation, landscape restoration, climate-smart agriculture, geothermal and clean energy development, energy efficiency, and drought and flood risk management. However, none of these plans have outlined how education can be used as a tool for addressing climate change.

Kumar et al. (2023) underscores the paramount importance of education in promoting Climate Action. Education is acknowledged as a vehicle that transforms lives by unlocking the potential of citizens (Kariuki, 2017). Quality education is Goal Number 4 in the World's Sustainable Development Goals (SDGs). It is identified as the key that will allow achievement of other SDGs including Goal 13 on Climate Action. The SDGs and the United Nations Educational, Scientific and Cultural Organization (UNESCO) Global Education Monitoring Report (2020) inform the role of education in addressing climate change. This is especially important given that understanding the causes and effects of climate change is, as posited by Sofiyan et al. (2019), the first step in shifting mindsets, establishing new ways of limiting its impact and adapting to its unavoidable effects. There is, therefore, need to make education more responsive to climate change by integrating or mainstreaming its aspects in the curriculum of schools.

Many countries, especially in the developing world, are reforming their education systems in order to meet the demands for the 21st century (Kabita & Ji, 2017). The SDGs recommended Education for Sustainable Development (ESD) which aims to promote knowledge, skills, attitudes and values necessary to shape a sustainable future (Ministry of Education [MoE], 2018). ESD proposes learning methodologies that are suitable for promoting critical thinking, problem-solving skills as well as collaboration.

Kenya is in the process of reforming its education with a shift from the Knowledge-Based Curriculum (KBC) to a Competency-Based Curriculum (CBC). This shift is informed by the country's desire to achieve its national aspirations as well as meet the international obligations. The shift is meant to provide for integration of Kenyan education to that recommended for the East African Community (EAC) (EAC, 2012); align the education to the requirements of the Constitution of Kenya (2010); and equip the youth with requisite competencies that will propel Kenya to achieve the Vision 2030 which is the country's blue print for national development.

According to the Sessional Paper Number 2 of the Republic of Kenya of 2018 on Reforming Education and Training for Sustainable Development, the reform process is a response to the challenge of providing relevant and quality education. Proponents of CBC argue that by focusing on competencies (what learners can do) rather than objectives (what learners are expected to know) with the education they receive, CBC is better suited to ensuring that education responds to the needs of the society.

The new CBC in Kenya is designed to develop individuals in a holistic way, which will produce citizens who are competent intellectually, emotionally and physically. The Basic Education Curriculum Framework (BECF) outlines seven core competencies to be achieved by every learner in basic education: communication and collaboration; self-efficacy; critical thinking and problem solving; creativity and imagination; citizenship; digital literacy; and learning to learn. (Republic of Kenya (2015). The basic education under CBC has identified six pertinent and contemporary issues facing Kenyan society to be embedded in the curriculum. One of these areas

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is Education for Sustainable Development (ESD) which includes environmental education as one of the pertinent and contemporary issues. It would be expected that aspects of climate change should be covered under this theme. Indeed, one of the goals of education in Kenya points to promotion of positive attitude towards environmental protection.

Mainstreaming Aspects of Climate Change in Education

Studies worldwide have attempted to analyse the extent to which elements of climate change have been integrated in the curricula of educational institutions. Nepras et al. (2022) carried out a review that focused on the topics covered in the curriculum for the Grades 1 and 2 pupils for the International Standard Classification of Education (ISCED). The study presented an analysis showing the breadth and frequency of the topics as reported by journals between 2009 and 2021. Results indicated that as the urgency of climate change increases so do the number and diversity of research studies on climate change. The areas that received significant attention included: knowledge about climate and climate change (47%), pro-environmental behaviours (42%), climate action (30%) and experiences regarding climate and climate change (20%).

Kumar et al. (2023) carried out a study in Pakistan that sought to find out the contribution of the Science, Technology, Engineering and Mathematics (STEM) curriculum in schools in generating effective mitigation solutions for Climate Change. The study results showed that climate change literacy increased by 94 percent in primary schools and 45 percent in secondary schools. The authors recommended development of tailored technology-enhanced STEM educational programmes for different age category of learners in order to improve learning outcomes regarding climate change.

A study by Sofiyan et al. (2019) aimed at analysing how climate change content integrated with the newly developed geography curriculum for secondary schools in Indonesia. The study used content analysis method to review the curriculum document. The study found that the topics of climate change in the syllabus were minimal and were dominated only by aspects of cognition. The condition outlined in the syllabus that the overall basic competencies should provide huge opportunity for students to learn climate change was not supported by the content. The study also established that teachers' understanding of the climate change content was limited leading to challenges in teaching aspects of climate change.

Walter et al. (2021) sought to find out the extent to which matters related to climate change were addressed within the teaching and research practices at the universities in several European countries. The focus was on the degree of involvement of the universities in reducing their own carbon footprint as well as identifying the training needs of the teaching staff. Respondents reported that climate change was a matter of concern in their countries and that there was a demand for professionals with adequate training in this area. Majority of the universities were found not to be fully prepared for addressing climate change in their curricula. The study recommended enhancement of international partnerships for promotion of climate change education and exchange of experiences among the universities to facilitate curricula innovations geared towards integrating aspects of climate change across the spectrum of their academic disciplines.

In Africa, Rwobusiiki et al. (2021) remarked that despite the great role played by education in creating knowledge and developing skills and attitude among people, little climate change and mitigation content exists in the taught curricula in most developing countries. Their study used a comprehensive content analysis to do a comparative assessment of the extent to which countries in the Eastern, Western, Central and Southern Africa had included climate change in their curricula and the efforts that these regions have done to adopt strategies and policies for mitigating climate

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change in their education systems. The findings included the fact that climate change is an emerging challenge for most African countries and that secondary schools in the region have climate change integration in their curricula at very low levels. The study recommended that African countries integrate aspects of climate change in their school curricula as a way of creating awareness and mitigating its impact. However, the study focused on secondary schools whereas the concepts should be grounded from the nascent stages of education.

Olalekan (2019) carried out a study which aimed at investigating the extent of integrating climate change issues in the upper basic school curriculum in the Gambia. However, the study focused on an audit of only two subject areas; social studies and geography. Among other findings was that there were gaps in the curricula in relation to climate change, for example, insufficient explanation of concepts. Anyanwu and Chimeze (2023) sought to find out the extent of integration of climate change into the social studies curriculum at the basic education level in Nigeria. The researchers discussed the relationship between climate change education and social studies curriculum content and concluded that the needed climate content awareness would be made possible via corresponding topics in the social studies curriculum. Hence, the study recommended that effective and efficient integration of concepts and learning experiences be made in the curriculum.

In Kenya, Kimiti and Cheruto (2013) highlighted the benefits of mainstreaming environmental education in the curricula of schools. The authors argued that mainstreaming environmental education would equip learners with the necessary knowledge and skills that are instrumental in preserving and conserving the environment. Indeed, Murikira (2019) opined that environmental education is a critical tool for combating climate change. According to Murikira, aspects of climate change have not been broken down in a way that the ordinary person can understand. In a study to find out the level of awareness of climate change aspects, Muchangi (2022) found that close to 75 percent of Kenyan university students are unaware of the global responses to climate change despite majority of them admitting to having experienced climate change-fuelled phenomena that included increased temperatures and erratic rainfall. More than 60 percent of the sampled students were unaware of the Kenya's National Climate Change Action Plan (NCCAP). However, is it the students who have ignored the plan or vice versa? It is notable that the plan does not mention anywhere how it intended to work with the Ministry of education to promote learners' awareness and response to climate change.

In a study to establish the contribution of school curriculum in creating awareness of climate change among learners in secondary schools in Githunguri Sub-County of Kenya, Kariuki (2017) found that the climate change content was inadequate and that implementation of the curriculum did not impact significant awareness in climate change. The study reported that of the sampled curriculum developers, 63 percent and 13 percent rated the curriculum as poor and very poor respectively with regard to infusion of climate change content in the curriculum. Among its recommendations, the study identified the need for further research to establish the infusion of climate change among learners in early stages of learning. This informed the rationale for the present study.

A formidable climate action starts with a tailored curriculum. As the Ministry of Education in Kenya scales up the CBC, it is an opportune time to anchor tailored Climate change content in the curriculum. CBC presents the best approach to transferring knowledge and skills to learners. The new education system has moved to the third level, the Junior Secondary after completing the Pre-primary and Primary school levels. To what extent has the curriculum for these basic levels embedded components of Climate change? This paper analysed the designs, referred to in the

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former 8-4-4 education system as syllabi as well as the course books for Pre-primary levels (PP 1-2) and Primary (Grades 16) with a view to appraising integration of Climate change aspects in the curricula.

The Enquiry and Theoretical Framework

The aim of the study was to use the existing documentary evidence to analyse the extent to which aspects of environment and climate change have been mainstreamed in the curriculum for Pre-primary (PP 1-2) and Primary schools (Grades 1-6) with a view to identifying gaps and inform the curriculum review process on the critical role that environmental education can play as a tool for combating climate change. The study sought to answer the following research question: To what extent has the new CBC curriculum for the Kenyan Pre-primary (PP 1-2) and the Primary (Grades 1-6) school covered aspects of environment and climate change?

The study was anchored on Bruner's Theory of Cognitive Development developed in 1966. The Theory as articulated by McLeod (2023) views the learner as an active agent of learning, and emphasizes the importance of existing schemata in guiding learning. As they learn, learners are encouraged to discern links between structures of the subject content; that is, concepts, facts and theories. According to McLeod, unlike other psychologists like Jean Piaget, Bruner did not contend that the stages in a learner's cognitive development are necessarily age-dependent or invariant. Bruner believed that development does not consist of discrete stages but is a continuous process. He argued that the aim of education should be to create autonomous learners that are ready to take responsibility of their own learning, thereby entrenching the competence of learning to learn as spelt out in the Kenya's BECF (2015).

Bruner (1966) was concerned with how knowledge is represented and organized through different modes of thinking or representation. In his theory, he suggested three modes of representation that included the enactive, iconic and symbolic modes. During the enactive mode which manifests between birth and when the child is one year, knowledge is primarily stored in the form of motor responses. Thinking is based entirely on physical actions by encoding physical action-based information and storing it in memory. During the next stage referred to as iconic mode and which manifests between the age of 1-6 years, information is stored as sensory images (icons) usually in visual form. These form pictures in the learner's mind. This explains the importance of using diagrams, pictures, illustrations and video images among others, to accompany verbal or written information during teaching. Thinking is also based on using other sensory mental images formed as a result of hearing, smelling or touching. In the last stage denoted symbolic mode of representation, knowledge is stored primarily as language, for example, mathematical symbols, words and music among others. During this stage which manifests when the child is above 7 years of age, symbols are a useful tool of learning as they can be easily manipulated, ordered or classified. The symbols are arbitrary.

As articulated by McLeod (2023), Bruner (1961) explained that the purpose of education is not to impart knowledge but to facilitate child's thinking and problem-solving skills. This makes active learners who are autonomous and who construct their own meaning. By extension, this implies that a child, irrespective of age, is capable of understanding any information however complex. This gives credence to the 'spiral' mode of curriculum development where content is structured so that complex ideas can be taught at a simplified level in the beginning and then re-visited at more complex levels later on. The spiral curriculum is based on the principle that learners should review a particular concept over and over again during their educational experience, each time building on the previous learning and increasing their sophistication continuously. Therefore,

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concepts like climate change can be taught as simplified content in lower levels and at gradually increasing difficult levels as the learner advances through the stages of learning.

Methodology

The study adopted the documentary analysis research which involves using already existing documented information as the data (Glenn, 2009). In this type of research, documents are reviewed by the analyst to assess an appraisal theme, which in this case is climate change. The documents are dissected with a view to establishing the extent to which a theme has been captured by the documents and how. The purpose is usually to answer specific evaluative questions with a view to making conclusions and recommendations based on the findings.

The aim of this study was to find out the extent to which components of Climate change have been infused in the curriculum for Pre-primary 1-2 and Primary Grades 1-6 in the current CBC dispensation in Kenya. The documents analysed comprised the designs for the grades and their respective instructional course books. The designs and course books analysed were limited to those for 'Environmental Activities' and 'Hygiene and Nutrition Activities' for learners up to Grade 3 and 'Social Studies' and 'Science and Technology' for learners from Grade 4 to Grade 6. Analysis involved identifying concepts in the general area of environment and mapping them onto a six-level profile on notions of climate and climate change.

Results and Discussion

The study sought to examine the extent to which aspects of environment and Climate change have been mainstreamed in the curricula of basic levels of learning in the CBC framework in Kenya. Environmental activities are important for young learners as they provide opportunity for exploration, experimentation and interaction with the immediate environment (Njuguna, 2012). In turn, these scientific processes enable the learner to acquire skills in order to enjoy learning, promote good health, safety and environmental conservation as well as appreciate the rich cultural diversity. The study noted that every design specified Kenya's educational goal number 8 which is to promote positive attitude towards good health and environmental protection.

The components of environment and climate change as identified in the documents for each level were scaled against a six-level hierarchical profile as detailed hereunder and the results were as displayed in the subsequent tables: Elements of weather; conservation of environment; causes of climate change; effects of climate change; mitigating effects of climate change; and adaptation to effects of climate change and resilience.

Findings from Table 1 indicate that for the levels up to Grade 3, the concepts covered mostly the lower conceptions that included elements of weather and conservation of the environment. These are aptly covered by the expected learning outcome as outlined in the designs for the levels for learning 'Environmental Activities'; that by the end of the Early Years Learning, the learner should be able to explore the immediate environment for learning and enjoyment. However, in order to capture elements of climate change, there is need to expand on the outcome and design suitable activities and experiences to achieve them. It is also notable that quite a number of the conceptions are only implied and not explicitly expounded in the course books. The conceptions have only been captured in form of pictures.

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Table 1: Concepts of Environment and Climate Change Covered in Pre-Primary and Primary Levels Grades 1-3

Profile Level	Concepts (with Relevant Activities)	PP. 1	PP. 2	GD. 1	GD. 2	GD. 3
1	Uses of elements of weather like winnowing	X				
	Elements of weather	X	X	X		
	Components of Environment	X	X	X		
	Weather conditions/suitable activities	X	X	X	X	
	Keeping/dressing safe in different weather				X	X
	Recording weather/decoding weather messages				X	
2	Managing waste (Collecting and burning garbage) – safe handling	X		X		X
	Care for the immediate environment		X			
3	Dangers of Polluting environment			X		
4	Dangers of water – Flooding (implied)		X			
	Extreme/unfavourable weather conditions		X*			X
5	Effects of unfavourable weather conditions					X*
	Warning people of impending extreme weather					X*
6	None					

*Means only implied

Grades 4-6 constitute part of the 'Middle School Learning' in the Kenyan CBC dispensation which covers 'Upper Primary' and 'Junior School' levels of education. For this level, environment and climate are covered under 'Social Studies' subject. The designs outline the expected learning outcome as follows; By the end of the Middle School Years Learning, the learner should be able to explore, manipulate, manage and conserve the environment effectively for learning and sustainable development. The element of sustainable development suggests aspects of climate change. After analysing the designs and the recommended course books for the levels, the concepts of environment and climate change were mapped out as outlined in Table 2.

Even though slightly different concepts were covered at these grades and at a higher level of cognition as seen in Table 2, the concepts were mostly in the lower hierarchies of climate change. It is notable that level 6, which is adaptation and resilience has not been captured at all. There is, therefore, need to expand the expected learning outcome to cover the aspects of climate change. It was also notable that the designs failed to capture the golden chances of advancing concepts of climate change on a number of concepts. For example, on the concept of the influence of climate change on human activities, the vice versa-influence of human activities on climate was completely ignored. There was no concept identified on the components or manifestations of climate change, like extreme weather conditions. Similarly, there was no conception on the effects of climate change like drought and flooding.

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Table 2: Concepts of Environment and Climate Change Covered in Primary Levels Grades 4-6

Profile Level	Concepts (with Relevant Activities)	GD. 4	GD. 5	GD. 6
1	Seasons in the County and activities related	X		
	Weather elements and the sky (weather conditions)	X	X	
	Recording weather	X		
	Meaning of weather and climate		X	
	Climatic regions in Kenya/East Africa		X	X
	Main physical features in East Africa			X
	Influence of climate on human activities			X
2	Conserving physical features and natural resources	X	X	X
	Waste management and cleaning the environment	X	X	
	Conservation and protection of natural resources	X		
	Care for vegetation in school			X
3	Air/water pollution and its effects	X*		X
4	None			
5	Environmental club activities in schools	X*		
6	None			

*Means only implied

The foregoing findings are in tandem with those of other studies in developing countries and even some of the so-called developed countries. For example, Sofiyan et al. (2019) reported minimal and insufficient content to cover aspects of climate change in the curricula of schools in Indonesia. Similarly, Anyanwu and Chimeze (2023) found that the climate change content covered in the social studies school curriculum in Nigeria was minimal to make any significant impact to address the impact of climate change.

Conclusions and Recommendations

From the foregoing findings, the study derived a number of conclusions. Firstly, that there is a fair attempt by the curriculum of basic education to include aspects of environment and climate that aptly cover the expected level learning outcome as outlined in the designs. However, the curriculum is scanty in the concepts of climate change. Still, on the few concepts touching on climate change, the distribution of the concepts is skewed with those covering content on mitigation and adaptation as well as resilience receiving very little or no attention at all.

Secondly, the curriculum has attempted to build up the concepts from lower to higher levels of cognition. The same or similar concepts have been covered across the grades at different cognitive levels. This is in tandem with Bruner (1966) Theory of Cognitive Development. For example, some of the conceptions like physical features were developed from those found in the locality to those available in the Counties, in Kenya and in the East African region in general. Similarly, the topic of pollution has been handled from causes, its effects and its safe management. In the same vein, high level concepts of climate change like adaptation and resilience can be covered at low cognition, like learning to dress for unfavourable or extreme weather conditions.

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Thirdly, the curriculum failed to exploit available opportunities to mainstream critical components of climate change. These include, among others, the effects of human activities on the environment leading to climate change; negative effects of industrialization; and the harmful greenhouse effects of Carbon IV Oxide. These concepts could have been captured alongside the concepts of influence of climate on human activities, positive impact of industrialization and the benefits of Carbon IV Oxide, like use in fire extinguishers, that have been adequately covered by the designs.

In the light of the findings and the conclusions, the study made specific recommendations. As the government works on the national Climate Change Action Plan for the year from 2023 after expiry of the previous plan, there is need to outline a clear strategy on how education right from the basic levels to teacher and university education should be used to address climate change. This should be done in constant consultation and engagement of all relevant stakeholders.

The goals and learning outcomes that guide environment education should be reviewed with the aim of expanding them to aptly cover components of climate change. This will allow for suitable content and learning activities as well as experiences that will expose learners to climate change; its causes; effects; mitigation and adaptation; and resilience. This is likely to impart knowledge, skills, attitudes and values to grow up on the learners while embracing in them, the tenets of climate resilience for sustainable development.

Curriculum development experts, teachers, book writers and researchers should make concerted effort to develop relevant content, including digital content and derive appropriate learning activities and experiences as well as assessment strategies for concepts of climate change. This will facilitate effective mainstreaming of concepts of climate change in the curriculum of schools and colleges as a way of mitigating and coping with the effects of its change.

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