

Addressing Climate Change Education in Senior Secondary School Curriculum in Malawi

Duncan Wadson^{*1}, Innocent Mutale Mulenga², Inonge Milupi²

¹Directorate of Quality Assurance, Malawi

²The University of Zambia, Zambia

^{*}Corresponding Author

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ABSTRACT

The aim of this study was to examine how Climate Change Education (CCE) is addressed in Senior Secondary School Curriculum in Malawi. Quantitative and Qualitative data were gathered through interviews and surveys in 52 secondary schools in Shire Highlands Education Division (SHED) and South West Education Division (SWED). A sample of 422 participants consisting of 416 senior secondary school teachers, three inspectors of schools and three officers responsible for curriculum development was employed. It was found that the senior secondary school curriculum in Malawi did not adequately address CCE and it was not up-to-date. For instance, the curriculum did not capture climate change hazards such as cyclones despite the country having been hard hit by Cyclone Gombe, Cyclone Ana, Cyclone Freddy and Cyclone Chido. Finally, it is recommended that the curriculum should be integrated with many sustainable practical activities and strategies for climate change mitigation and adaptation.

Key words: Climate change education, school curriculum, sustainable practical activities, Malawi.

INTRODUCTION

Climate change (CC) is arguably one of the most severe global concerns of our time. The former president of the United States of America; Barack Obama once said, “No challenge poses a greater threat to future generations than climate change” (Vaughter, 2016). If not addressed now, CC will be a huge impediment to sustainable development as it permeates all socio-economic sectors of the society. The Intergovernmental Panel on Climate Change (IPCC) (2014) assessment report warned the global community that urgent action is required to halt the worst effects of global CC. It emphasized a need to view both adaptation and mitigation within a wider framework of climate-resilient development pathways to realise the Sustainable Development Goals. This requires CCE in all sectors of education (UNESCO, 2015). The IPCC defined CC as a change in the state of the climate that can be identified by changes in the mean or the variability of its properties, and that persists for an extended period, typically decades or longer (United Nations Framework Convention on Climate Change (UNFCCC), 2011). UNESCO (2015) defined CC as a global phenomenon of climate transformation characterized by the changes in the usual climate of the planet regarding temperature, precipitation and wind that are especially caused by human activities. In other words, CC can be defined as a long term shift in the planet’s weather patterns and average temperatures due to the release of carbon dioxide and other greenhouse gases into the air.

Education is recognized as one of the powerful tools for combatting CC as it raises awareness which helps students to make informed decisions when interacting with the environment and plays an essential role in increasing adaptation and mitigation capacities of communities (Nhamo and Shava, 2014). The former Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC), Christiana Figueres, emphasized that it is critical to include CC in curricula and should be embedded in the DNA of today’s education concept (Langlois, 2019). For a long time, UNESCO promoted so-called Environmental Education but in the 1980’s the social dimension was strengthened and Education for Sustainable Development (ESD) was introduced. This has evolved over time following criticism that it did not sufficiently address CC. Later on, it

was agreed that CCE should be part of Global Action Programme.

In Malawi, CC has brought negative impacts on education, agriculture, health, economy, transport systems, water resources, human settlement and energy. It affects food security and water supplies through changing

precipitation patterns, and impacts infrastructure through the increasing intensity of storms, cyclones and floods. Although CC is not new, many people including secondary school teachers and students know little about the concept (Malawi Institute of Education, 2013). However, CC is an important cross-cutting issue and its impact and effects on Earth are such that everyone in Malawi ought to understand it. It is therefore clear that efforts should be made to address the adverse impacts of CC. In view of this, it is a must that CCE should be infused in school curriculum so that all the students should acquire knowledge, skills and attitudes for them to respond to the faster rate of CC. On the contrary, a study that was conducted by Nhamo and Shava (2014) revealed that CCE is not yet fully incorporated into the school curriculum in the Southern African Region including Malawi.

It is through CCE in school curriculum where the students can learn what CC is, its impacts and effects, how to mitigate the impacts and effects, and what strategies to put in place to make the society better prepared in combating CC. What the students learn today will shape the world of tomorrow. Therefore, CCE has a role to play in helping the general public and especially the next generations understand and relate to the issues, make lifestyle changes to reduce greenhouse gas emissions, and adapt to the changing local conditions (Reyeles-Carrasco, Barron and Hernandez, 2020). The school curriculum should holistically be transformed by ensuring that all the students have an opportunity to acquire knowledge and skills about CC.

Evidence of climate change in Malawi

It is undisputable that CC is taking place in Malawi because its effects are visible in most places within the country. There is an increase in temperature across the regions whereby the southern region dominates (Climate Change Knowledge Portal for Development, 1931 - 2020). This is due to an increase in greenhouse gases in the atmosphere. The Malawi Climate Action Report (2016) revealed that in 2015, forestry contributed 78% of the emissions, followed by agriculture at 16% and energy at 4%. It further projected that between 2015 and 2040, total annual greenhouse gas (GHG) emissions will increase by approximately 38%. The average annual temperature in Malawi is estimated to increase by 1.1°C to 3.0°C by 2060. Table 1 shows data for the average seasonal mean temperature in Malawi from 1931 to 2020.

Table 1: Observed average seasonal mean temperature changes in degrees Celsius (°C)

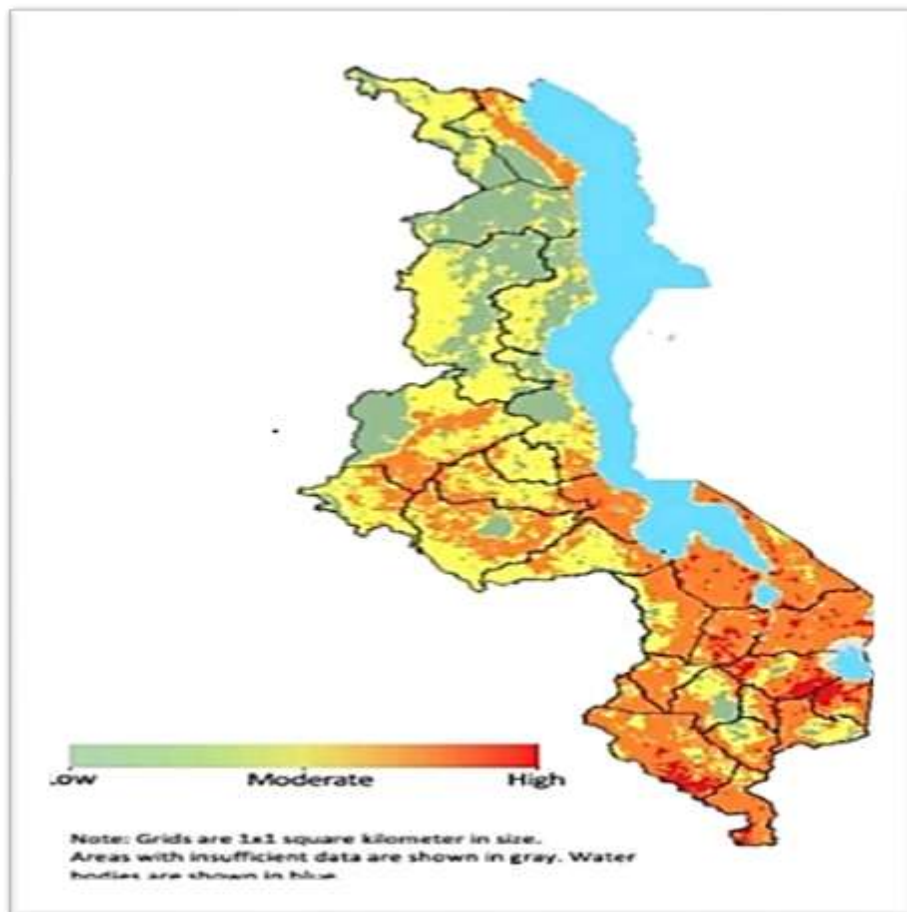
	1931 – 1960				1961 – 1990				1991 – 2020			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Malawi	23.45	21.98	18.68	23.93	23.38	21.95	18.74	23.80	23.93	22.49	19.43	24.51
Southern Region	24.64	23.43	20.37	25.11	24.59	23.44	20.42	24.99	25.11	23.95	21.08	25.65
Northern Region	21.88	20.58	17.45	22.46	21.88	20.65	17.51	22.39	22.39	21.14	18.19	23.03

Source: Climate Change Knowledge Portal for Development, 1931 – 2020

Table 1 shows that there is an increase in seasonal mean temperature over the years and the highest is in the Southern Region of Malawi. This is a clear evidence that CC is really taking place. In terms of rainfall, projections are not consistent across models and thus do not indicate substantial changes in annual rainfall (Climate Change Action Report, 2016). Models consistently project increase in the proportion of rainfall that falls in heavy events. The World Bank's country profile suggests a possibility that rainy seasons in Malawi will grow shorter which would lead to more frequent failures of the maize crop with significant implications for food

security.

Figure 1 showing areas vulnerable to climate change in Malawi



Source: <https://fraym.io/blog/malawis-adaptive-capacity-to-climate-change>

The Southern Region of Malawi is more vulnerable to CC as it is becoming common for meteorological hazards such as cyclones, floods, heatwaves and droughts to hit the region. This seriously affects agricultural activities, power supply, education and transportation among others. For instance, Cyclone Ana which occurred in January, 2022 led to closure of schools in the Southern Region of Malawi for a week (United Nations, 2022). This was followed by Cyclone Gombe in March, 2022 that destroyed maize fields and displaced 106, 879 people. In March, 2023; the Southern Region of Malawi was seriously hit by Cyclone Freddy which killed more than 1000 people, displaced 650, 000 people and left an estimated 2.3 million people in need of humanitarian support (WFP Malawi, 2023). It further submerged and washed away thousands of hectares of crops. The whole Mtauchila village in Chiradzulu district was washed away by the landslides caused by Cyclone Freddy. Nkhulambe Health Centre in Phalombe district was destroyed killing some patients who were inside.

Climate Change Education in Malawi

Malawi is a signatory to several international conventions that address CCE and awareness. Beginning with the Earth Summit in June 1992, the government of Malawi has taken part in many activities and agreements, for instance: the United Nations Framework Convention on Climate Change (UNFCCC); the Convention on Biological Diversity (CBD); the United Nations Convention to Combat Desertification (UNCCD); the Statement of Forest Principles (SFP); and Agenda 21 (Nhamo and Shava, 2014). In 2008, the Kyoto Protocol was launched to strengthen the response to CC. The Government of Malawi has developed and reviewed a number of legislative frameworks aimed at promoting and consolidating environment, CC and other socio-economic developmental activities in the country (Joshua and Namphande, 2014). Some domestic laws and policies have a bearing on CCE. In 2021, Malawi participated in the United Nations Climate Change Conference (COP 26) in

the United Kingdom where one of the objectives was to reduce greenhouse gases by 2030. Consequently, efforts are being taken to implement agreed protocols and conventions through CCE.

The Constitution of the Republic of Malawi (1994), Section 13(d) stipulates the need “to manage the environment responsibly in order to preserve the degradation of the environment, provide a healthy living and working environment for the people of Malawi, accord full recognition to the rights of future generations by means of environmental protection and sustainable development of natural resources and enhance the biological diversity of Malawi”. In line with this, CCE can be integrated into the education system in order to achieve the country’s aspirations. Although there has been a lot of effort directed towards CCE and awareness in the country, Joshua and Namphande (2014) noted that the absence of a clear policy resulted in the lack of an integrated approach to CCE and awareness initiatives. The formal education, for instance in secondary schools, there has been more emphasis on environmental education than on CCE.

As part of fostering CCE in secondary schools, the former Minister for Natural Resources, Energy and Mining, Mr. Bright Msaka launched a new CC sourcebook for secondary school teachers in the presence of the UN Coordinator Ms. Mia Seppo (Malawi Institute of Education, 2015). The book was launched in the first ever climate week in Malawi in 2015. Being a new topic in secondary schools, it was anticipated that teachers of various subjects would have challenges to access content on CCE. That was why a sourcebook on CC was developed to address the challenge. It was developed by the Malawi Institute of Education with support from UN CC: Learn and the United Nations Development Programme (UNDP). The Malawi Institute of Education is part of the National Technical Committee on CC (Joshua and Namphande, 2014).

METHODOLOGY

The study employed mixed method convergent parallel design research which was conducted in senior secondary schools in the Southern Region of Malawi. Mixed methods helped to produce a more complete picture and provided an opportunity for a greater assortment of divergent or complementary views; which were valuable and enriched an understanding of a phenomenon (Dawadi, Shrestha and Giri, 2021). In a convergent parallel design, the researcher concurrently conducted the quantitative and qualitative elements of the same phase of the research process, weighed the methods equally, analysed the two components independently, and interpreted the results together (Creswell and Plano Clark, 2011). The integration of data in a convergent parallel design helped a researcher to develop results and interpretations that were comprehensive and validated (Creswell and Plano Clark, 2018).

This research had an intermediate ontological position acknowledging the fact that both objective and subjective views of the reality were useful. Gray (2013) defined ontology as the perception or view point regarding existence of man, society and the world in general on the one hand, and relationship among them on the other hand. In other words, ontology deals with the nature of the entities of the world and the assumptions of reality about them (Ansari, Panhwar and Mahesar, 2016). The two major ontological perceptions regarding social world reality are: reality is one, and multiple realities co-exist in a social world (Creswell and Plano Clark, 2018). Therefore, in this mixed research, the researchers’ ontological perspectives was positioned in the middle of two extremes: fully objective to fully subjective. The quantitative part was positioned on objective, while the qualitative part was positioned on subjective. The researcher acknowledged that both objective and subjective views of the reality were useful.

Interviews, questionnaires and document analysis were used as data collection methods and instruments. A total sample of 422 participants consisting of 416 senior secondary school teachers, three inspectors of schools and three officers responsible for curriculum development was employed. A statistical formula $n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$ was used

to arrive at the sample. Pilot testing of questionnaires and semi-structured interview guides was conducted to ensure that the questions conformed to research objectives. Questionnaires were first distributed to 16 teachers in two schools which were not part of the sampled schools. This also assisted to ensure validity and reliability of research instruments. Corrections were made before distributing the questionnaires to the research participants. Quantitative data was analysed using the Statistical Package for the Social Sciences (SPSS) to come up with tables while qualitative data was analysed thematically.

To examine how CCE is addressed in senior secondary school curriculum in Malawi, questionnaires were distributed to 416 senior secondary school teachers in 52 schools. Further, semi-structured interviews were conducted whereby the three curriculum developers and three inspectors of schools were asked questions on how CCE is addressed in senior secondary school curriculum. An analysis of the content in the syllabi for the eight selected subjects that most students in senior secondary schools choose to learn was conducted. The subjects were: Geography, Agriculture, Biology, English, Chichewa, Chemistry, Physics and Social Studies. The use of questionnaires, structured interviews and document analysis helped to generate very rich and vigorous data which was more reliable and valid (Plano Clark and Ivankova, 2016).

Additionally, an analysis of interventional strategies on how the senior secondary school curriculum in Malawi can be improved was done. Questionnaires were distributed to 416 senior secondary school teachers. This data was analysed using the SPSS software. The structured interviews were conducted whereby the three curriculum developers and three inspectors of schools were asked questions on the interventional strategies for improving the senior secondary school curriculum in Malawi. The semi-structured interview data was analysed thematically.

Study findings

The analysed data was guided by two objectives; to examine how CCE is addressed in senior secondary school curriculum in Malawi and to examine the interventional strategies on how the senior secondary school curriculum in Malawi can be improved. To address the first objective, senior secondary school teachers were asked the extent to which they agreed or disagreed on how the senior secondary school curriculum addresses CCE. This was done through questionnaires which were distributed in secondary schools.

Extent to which the senior secondary school curriculum addresses CCE

Table 2: Extent to which the senior secondary school curriculum addresses CCE

Key: f = frequency; % = percent

Item		Agree		Not sure		Disagree			
		f	%	F	%	f	%	Total f	Total %
1	The content in syllabi is not up-to-date, therefore, it should be updated with the current climate change events.	326	78.4	11	2.6	79	19	416	100
2	Climate Change Education content is not adequately infused in all the subjects.	297	71.4	14	3.4	105	25.2	416	100
3	Much Climate Change Education content is infused in Geography only.	290	69.7	33	7.9	93	22.4	416	100
4	Climate Change Education content in senior secondary school curriculum may not adequately assist in solving local problems.	289	69.4	13	3.1	114	27.4	416	100
5	The content does not include sustainable practical activities for mitigating climate change.	282	67.8	17	4.1	117	28.1	416	100

6	The content in senior secondary school curriculum mostly outlines globalized causes, mitigation measures and impact of climate change without contextual relevance to Malawi.	278	66.9	24	5.7	114	27.4	416	100
7	The content in senior secondary school curriculum is not enough for causing behavioral change in students.	278	66.8	54	13	84	20.2	416	100
8	I do not teach much about climate change because of limited syllabus coverage.	244	58.7	25	6	147	35.3	416	100

Source: Field Data, 2022

From the data in Table 2, the majority of the teachers (78.4%) agreed that the content in senior secondary school syllabi is not up-to-date and should be updated with the current CC events. This is followed by 71.4% who agreed that CCE is not adequately infused in all the subjects. Next, 69.7% agreed that much CCE content is infused in Geography only, while 69.4% agreed that much CCE content in senior secondary school curriculum may not assist in solving local problems. Additionally, 67.8% of teachers agreed that the content in senior secondary school curriculum does not include sustainable practical activities for mitigating CC.

Document analysis was conducted to examine whether the content in senior secondary school syllabi addresses CCE or not. This was done in eight selected subjects that most students in senior secondary schools choose to learn. The subjects were: Agriculture, Biology, Chemistry, Chichewa, English, Geography, Physics and Social Studies. The data is shown in Table 3.

Table 3: Analysis of senior secondary school syllabi

Key: x = No; √ = Yes

Item		Agric.	Biol.	Chem.	Chich.	Eng.	Geog.	Phy.	Soc.
1	The syllabus has up-to-date content about Climate Change Education.	X	X	X	X	X	x	x	x
2	The syllabus has adequate content which addresses Climate Change Education.	X	X	X	X	x	√	X	x
3	Climate Change Education only appears as a separate topic.	√	x	x	x	x	√	X	√
4	Climate Change Education is integrated in many topics.	X	x	x	x	x	x	x	x
5	The success criteria in the syllabus have action verbs that promote learning climate change through practice / learning by doing.	x	X	X	X	x	X	x	x

6	Most activities in syllabus may lead to change of attitudes, knowledge and practices of students on issues of climate change.	x	x	x	X	x	X	x	X
7	The syllabus has Climate Change Education content that may assist in solving local problems.	√	x	x	X	x	x	x	x
8	The syllabus mostly outlines globalized causes, mitigation measures and impact of climate change without contextual relevance to Malawi.	X	√	x	√	√	√	√	√

Source: Field Data, 2022

The results in Table 3 indicated that the content in syllabi for all the eight subjects was outdated. The syllabi for senior secondary schools were last updated in 2013 and have events that occurred more than 10 years ago. This implies that the latest CC meteorological hazards, for instance; Cyclone Ana, Cyclone Gombe, Cyclone Freddy and Cyclone Chido cannot be found in the curriculum.

Data showed that the syllabi for senior secondary schools do not have adequate content which addresses CCE except in Geography. In other subjects, for example Chemistry, there is no any content about CCE. In Biology, CCE content only appears in Form 3 but misses in Form 4. The results have shown that CCE only appears as a separate topic in in Social Studies, Geography and Agriculture. Although Social Studies is one of CCE carrier subjects, the content about CC only appears in Form 3 but misses in Form 4.

Further, document analysis indicated that most success criteria in the eight syllabi have action verbs that do not promote learning CCE through practice or by doing. It is common to find the action verb “explain” which promotes theory learning. For instance, the senior secondary school Geography syllabus has the following success criterion in the topic “Climate change” on Page 49: “Explain the meaning of the term climate change”, “Explain climate change mitigation and adaptation measures” and “Examine causes and effects of climate change”. In these success criteria, the action verbs are theoretical and not practical. This cannot transform the students’ minds in terms of taking action in mitigating CC. Data also indicated that most CCE content in senior secondary school syllabi may not assist in solving local problems, for instance, deforestation which is now very serious in Chikangawa forest in Malawi (Ngwira and Watanabe, 2019). In most subjects, the syllabi outline globalized causes, mitigation measures and impact of CC without contextual relevance to Malawi.

To triangulate more data, the researcher conducted interviews with six key informants. These were three curriculum developers at MIE and three inspectors of schools in the departments of sciences, humanities and languages. The curriculum developers C1, C2 and C3 represented the departments of sciences, humanities and languages respectively. Similarly, the inspectors of school Q1, Q2 and Q3 represented the departments of sciences, humanities and languages respectively.

The curriculum developers were asked if the senior secondary school curriculum addresses CCE in all the subjects. The following were some of their responses:

C1: No, the curriculum does not offer CCE in all the subjects. It is already overloaded and we cannot force ourselves to infuse more CCE content. Instead, we have the carrier subjects which have content about CCE. These are Geography, Social Studies and Agriculture.

C2: Although CC is a cross-cutting issue, it is not offered in all the subjects. We have the subjects where it is

mainly found, for instance, in Geography and Social Studies.

C3: No, CCE content is not taught in all the subjects, but there are subjects like Geography, Social Studies and Agriculture where the content about CC is found.

Similarly, the inspectors of schools were asked if the senior secondary school curriculum addresses CCE in all the subjects. The following were some of their responses:

Q1: In reality, the curriculum does not include CCE in all the subjects. Even in the subjects that are believed to be the carriers of CCE like Geography and Social Studies, the content that we find there is not enough for transforming the students' minds. It would be necessary to include adequate CCE content in all the subjects so that students should appreciate the need to take action it.

Q2: There are mainly three subjects in senior secondary school curriculum where CCE is addressed in more comprehensive manner. We have Geography, Agriculture and Social Studies. But CCE content is not adequately covered in other subjects where we can only find two sentences talking about CC, then disappear completely.

From the findings, both curriculum developers and inspectors of schools revealed that CCE is not addressed in all the subjects except the three subjects which are Geography, Agriculture and Social Studies.

The inspectors of schools were asked if the schools had adequate teaching and learning materials to address CCE. The following were the responses:

Q1: Many schools do not have adequate teaching and learning materials for CCE. This is due to lack of enough funding to purchase the teaching and learning materials, for instance, CCE sourcebooks, posters and other materials for weather station such as thermometers, rain gauge and sunshine recorder.

Q2: Unfortunately, most secondary schools that we have inspected are lacking teaching and learning materials to support CCE. This is a challenge that needs to be addressed in order to implement CCE effectively in the curriculum. There is a need for schools to have adequate CCE sourcebooks, posters, drums for water harvesting from roof tops and other materials for waste management.

The findings from inspectors of schools indicated lack of teaching and learning materials in most secondary schools.

Intervention strategies on how to improve the senior secondary school curriculum

An examination of the interventional strategies on how the senior secondary school curriculum can be improved was done. Questionnaires were distributed to 416 senior secondary school teachers and were asked to indicate the extent to which they agreed or disagreed with the statements regarding to the intervention strategies that may be taken to improve the senior secondary school curriculum. The data is shown in Table 4.

Table 4: Intervention strategies to improve the senior secondary school curriculum

Key: f = frequency; % = percent

Item		Agree		Not sure		Disagree		Total	
		F	%	f	%	f	%	f	%
1	The education sector should formulate operational policies about Climate Change Education in school curricula.	368	88.5	5	1.2	43	10.3	416	100

2	Climate Change Education content must adequately be infused in all the subjects or across the curricula.	362	87	3	0.7	51	12.3	416	100
3	The curriculum developers should update the senior secondary school curriculum with the latest Climate Change Education content.	347	83.4	13	3.1	56	13.5	416	100
4	The senior secondary school curriculum should have many practical activities about climate change mitigation and adaptation that may promote learning by doing.	328	78.8	8	1.9	80	19.2	416	100
5	Schools and communities should work together in climate action projects that may assist to mitigate and adapt to climate change.	312	75	6	1.4	98	23.6	416	100
6	Schools should be provided with enough teaching and learning resources, for instance, climate change posters and sourcebooks.	258	62	12	2.9	146	35.1	416	100
7	Teachers must be well trained on how best they can teach Climate Change Education content in schools.	242	58.2	8	1.9	166	39.9	416	100
8	There must be monitoring and evaluation on Climate Change Education in schools.	234	56.3	5	1.2	177	42.5	416	100

Source: (Field Data, 2022)

Data in Table 4 shows that the majority of teachers (88.5%) agreed that the education sector should formulate operational policies about CCE in school curricula. This is followed by 87% of teachers who agreed that CCE content must adequately be infused in all the subjects or across the curricula. Next, 83.4% of teachers agreed that the curriculum developers should update the senior secondary school curriculum with the latest CCE content, while 78.8% of teachers agreed that the senior secondary school curriculum should have many practical activities about CC mitigation and adaptation that may promote learning by doing, 75% of teachers agreed that schools and communities should work together in climate action projects that may assist to mitigate and adapt to CC, 62% agreed that schools should be provided with enough teaching and learning resources, for instance, CC posters and sourcebooks, while 58.2% of teachers agreed that teachers must be well trained on how best they can teach CCE content in schools.

Through interviews, the inspectors of schools Q1, Q2 and Q3 were asked to suggest the interventional strategies on how to improve the senior secondary school curriculum. The following were some of the responses:

Q1: The curriculum is supposed to be reviewed and updated periodically. We are using an outdated curriculum as it is close to ten years now. It is also necessary to look for spaces in all the subjects where the content about CC is not adequate, and must be included. The Ministry of Education should also distribute books about CCE to secondary schools in large numbers. This may assist teachers and students to read a lot of CC information.

Q2: I think CCE as a crosscutting issue should be spread across all the subjects in the curriculum. Apart from that, there must be an emphasis on use of participatory methods to get maximum benefits in terms of skills acquisition by the students that can be applied practically. There is also a need for the schools to have enough teaching and learning materials such as CCE sourcebooks, posters and other materials to be used in different

CCE projects, for instance, drums for water harvesting from roof tops. This can be achieved if the Ministry of Education allocates enough funds to schools.

Q3: The curriculum developers should make sure that CCE content is adequate in all the subjects. It should be well detailed in all the subjects. The nature of comprehension questions, for instance in languages should be revised in the way that the questions must assist students to reflect on issues of CC and their actions so that they can change their attitudes and practices in order to mitigate and adapt to CC.

DISCUSSION

The study findings in Table 2 have shown that most teachers agreed that the content in senior secondary school curriculum was outdated. Similarly, through document analysis of the senior secondary school syllabi as shown in Table 3, it was revealed that the curriculum was not up-to-date. The semi-structured interviews with the inspectors of schools indicated that the senior secondary school curriculum was last updated in 2013. This implies that it only includes content with climatic events not later than 2013 (Malawi Institute of Education, 2013). This is a drawback in the process of addressing CCE in Malawi. Nhamo and Shava (2014) observed that most textbooks in curricula for SADC countries, for instance in Seychelles, were outdated and would not lead to sustainable management of the environment. Nambela (2016) argued that the curriculum should be reviewed regularly so that students should acquire knowledge, skills and attitudes that are in line with the new events or changes in the country.

A lot of latest meteorological extremes that occurred as a result of CC have not been included in secondary school curriculum in Malawi. For instance, the meteorological hazards of Cyclone Bansi in 2015, Cyclone Idai in 2019, and Cyclone Ana and Cyclone Gombe in 2022 (United Nations, 2022). All these have not been infused in secondary school curriculum despite causing serious effects in Malawi. A situation of having an outdated curriculum also exists in Tanzania where Kira and Komba (2015) found that Geography textbooks had outdated content which provided unclear concepts on issues of environmental degradation, weather and climate, power use and CC. Similarly, a study by Ronald, Merab and Byalusaago (2017) revealed that the secondary school curriculum in Uganda was outdated. This means that there is a need for all countries in Africa to join hands by updating their curricula with the latest CCE content.

The findings from questionnaires in Table 2, document analysis of syllabi in Table 3 and the interviews with curriculum developers indicated that CCE content was not adequately infused in all the subjects. The content about CC appeared as a separate topic in three carrier subjects which were Geography, Agriculture and Social Studies. The curriculum developers argued that the curriculum was overloaded, therefore they could not force themselves to infuse CCE content in all the subjects. That was not good for the students because the infusion of content in the syllabi should be based on needs assessment. UNESCO (2015) explained that CC is an emergency issue and must be infused in all the subjects in the school curriculum.

Although CC content is partly included in Geography, Agriculture and Social Studies; the content is not adequate. For instance, the topic “Cyclones” in senior secondary school Geography only requires the students to discuss the development of tropical and temperate cyclones, locate temperate cyclones on world map and compare weather associated with tropical and temperate cyclones (Malawi Institute of Education, 2013). There is no any content about the impacts that tropical cyclones are causing in Malawi as a result of CC. It also leaves out the content on how the impacts caused by cyclones can be mitigated. This cannot bring enough transformation in the attitudes and values of the students. In Namibia, Tshiningayamwe (2018) found that the coverage of CCE content in secondary school curriculum was inadequate. Kasembe and Chabikwa (2014) found that the coverage of CCE content in senior secondary school curriculum in Zimbabwe was inadequate. This clearly shows that not only the curriculum for Malawi has inadequate content, but also other countries in SADC region have shortfalls that need to be addressed.

The findings in Table 2 and Table 3 have further shown that the senior secondary school curriculum does not adequately assist in solving local problems. This has created a situation in which what students learn at school is different from the lived experiences at home. For instance, there is massive deforestation in Mulanje Mountain which is located in the Southern Region of Malawi which is also mostly affected by CC (Nangoma, 2016). This

was not included in the subjects being taught in senior secondary school curriculum. Instead, there is content which does not have contextual relevance to Malawi. For instance, in Geography, the topic “Climatic regions and world vegetation” has content that requires students to identify world climatic regions, characteristics of world climates and associated vegetation, and explain the influence of climate on world economic activities (Malawi Institute of Education, 2013). This content is presented in globalized manner than local and cannot assist in solving local problems in Malawi like deforestation, water pollution and food insecurity. Fleisch, Gultig and Maringe (2019) argued that the curriculum should assist students to solve local problems in Africa rather than Western problems.

According to UNESCO, local focus is critical in any attempt to understand and address CC. In a study that was conducted by Nhamo and Shava (2014) in SADC curricula, it was found that there was a deficit of CCE content for solving local problems. The local issues about CC have been marginalized, misinterpreted, invalidated and labelled as inferior. The shortfall of localised content about CCE was also observed in secondary school curriculum in Zambia (Muchanga and Nakazwe, 2015). Consequently, the students are equipped with narrow information on CC and may not appreciate the need for behavioural and social change to cope with CC in the local context.

The findings from inspectors of schools have shown that most schools do not have adequate teaching and learning materials for CCE. Although CCE source books were donated in schools through the United Nations Development Programme, they were not adequate to reach all the schools in Malawi (Malawi Institute of Education, 2015). Similarly, a study by Mulenga, Muchanga and Chidongo (2023) found that lack of teaching and learning materials in secondary schools in Zambia has hampered the integration of CCE and this has been caused by poor funding. Climate Change ought to be adequately covered in the curricula and syllabi if it is adequately reflected in the teaching and learning materials.

As an interventional strategy for addressing CCE in senior secondary school curriculum, the study findings in Table 4 indicated that most teachers (88.5%) agreed that the education sector should formulate operational policies about CCE in school curricula. Joshua and Namphande (2014) noted that the absence of a clear policy in Malawi’s education sector resulted in the lack of an integrated approach to CCE in school curriculum. The policies of different sectors, for example, education, water, forest, agriculture are not harmonized (Nhamo and Shava, 2014). Although there is an awareness about CC, it has largely been on top management levels in government ministries. This is a drawback in terms of addressing CCE in senior secondary school curriculum. Therefore, clear policies should be set to give mandate to education sector in addressing CC.

Table 5.15: A framework of intervention strategies for improving CCE in senior secondary school curriculum in Malawi

Strategy	Subject	Activity / Content
Projects	Agriculture	- Students should design a school garden and plant drought tolerant crops such as cassava, millet, sorghum and potatoes. - Organize research projects whereby students should investigate about climate change mitigation and adaptation practices in their communities. - Design irrigation project at a school whereby students can plant and irrigate crops in school garden even in the dry season. - Design water conservation project such as making box ridges and terraces on land for farming.
	Geography	- Organize tree planting project whereby students should take part in planting tree seedlings at their school campus and in their community. - Design rain water harvesting project such as collecting water from roof tops into tanks and constructing a dam for collecting run-off water.

		Organize surveys on climate change mitigation and adaptation strategies in their communities.
	Social studies	Organize waste management project whereby students can have activities such as paper recycling, sensitizing the community about waste management and create posters with messages about waste management.
	English	- Organize essay writing projects on climate change themes. Best essays should be published and best writers should be awarded. - Design projects of writing poems and short stories with messages about climate change.
Field trip	Agriculture	- Organize fieldtrips to farms where drought resistant crops are grown. - Visiting Agriculture research stations, for instance at Vumbwe Agricultural Research Station in Thyolo district in Malawi to see and learn about better varieties of crops that can mature faster and tolerate drought. - Visiting areas along river banks where farmers have cleared trees and planted crops close to the river. Students should discuss why floods occur and the river dries faster. They can later sensitize farmers to stop cultivating crops along the river banks.
	Geography	- In the topic “Fishing industry” students can visit areas surrounding Lake Chilwa where there is massive deforestation. Places such as Swang’oma, Kachulu, Naphali and Chikololizi were deforested by fishermen who used trees for drying fish. They can later sensitize them stop deforestation and take action by planting tree seedlings. - Visiting Mulanje Mountain which is heavily deforested. Learners should discuss the effects of deforestation on climate change. - Conduct an experiment for the formation of clouds.
	Social Studies	In the topic “Population” students can visit areas of high population such as areas around Michiru Hills in Blantyre. This is an area where people have cut down the trees carelessly and the land is left bare. Students can discuss how this may contribute to climate change. They can also discuss actions to be taken in order to solve the problem of deforestation.
Whole-school approach	Agriculture Geography Social studies Life skills	- Incorporate learning about local problems related to climate change and take actions in solving them. For instance students, parents, teachers and community leaders may collaborate in finding solutions for deforestation and food insecurity. - Students can establish and care for school gardens with community partners. - Student committee members should research on environmental issues that can educate the community. - Parents can provide funding to students to implement interdisciplinary research projects to improve school or community sustainability. - Collaborate with other schools, neighborhood associations, local organizations and networks on climate action.

		• Hold climate change awareness and action campaigns for students and community members.
Case study	Agriculture	• Include a case study about a short rainy season and its effects on crops that do not mature faster. Ask the students to suggest the solutions to this problem. • Develop a case study about cultivating crops along the river banks. Let the student discuss its effects on climate change.
	Geography Social studies Life skills	• Develop case studies for cyclones such as Cyclone Ana, Cyclone Gombe and Cyclone Freddy. Let the students discuss the effects of cyclones. Students should discuss climate change mitigation and adaptation strategies. • Design a case study about water pollution in Mudi River whereby some industries dump in poisonous chemicals. Let the students discuss how to solve the problem. • Develop a case study about deforestation in Chikangawa forest in Malawi. Students should discuss its effects on climate change and how to solve that local problem.
Debates	Geography Social studies Life skills	• Organize debates in the following areas: • Is global warming as a result of climate change primarily caused by human activities? • Should charcoal burning be banned in Malawi? • The role of the students and community in practices for climate change mitigation and adaptation.

CONCLUSION

This paper has examined how CCE is addressed in senior secondary school curriculum in Malawi. It has also examined the interventional strategies on how the senior secondary school curriculum in Malawi can be improved. Further, a framework of intervention strategies for improving CCE in senior secondary school curriculum in Malawi has been designed. From the examination, it is evident that curriculum is not up-to-date hence lacks the latest Climate Change content. The study has revealed that Climate Change Education content is not adequately infused in all the subjects. The study further showed that the CCE content currently in the curriculum does not adequately assist in solving local problems and does not have adequate sustainable practical activities for mitigating Climate Change. The study also revealed lack of clear policy to guide CCE in education sector.

RECOMMENDATIONS

The following are the recommendations of the study:

1. The Ministry of Education and Malawi Institute of Education should review the curriculum so that it can be updated with the latest CCE content. Doing so would give chance to the students to take action in the process of addressing CC as they may feel its impact extremely throughout their lives.
2. The Ministry of Education should provide adequate teaching and learning materials in secondary schools.
3. The Malawi Institute of Education should infuse CCE content in all the subjects across the curricula so that the students should holistically be transformed in behaviors and attitudes in combatting CC. In other words, CCE should be interdisciplinary.
4. There curriculum developers should infuse the content that may assist in solving local problems like deforestation, water pollution and food insecurity. There is a need to include practical activities for

mitigating and adapting to CC, for instance, water harvesting, planting tree seedlings, waste management project and planting drought tolerant crops.

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