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Teacher Preparedness and Strategies Used in Teaching of Climate Change Education in the Southern Region of Malawi

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Abstract: This study examined the preparedness of teachers and the strategies used in the teaching of Climate Change Education (CCE) in senior secondary schools in the Southern Region of Malawi. The mixed method convergent parallel design was employed as a scientific research methodology of examining this phenomenon. Data was collected from 422 participants consisting of 416 senior secondary school teachers in 52 schools, three inspectors of schools and three officers responsible for curriculum development. A statistical formula $\mathrm{n} = \frac{n_0}{1+\frac{n_0-1}{N}}$ was used to arrive at the total sample in the study. Questionnaires, semi-structured interviews and lesson observations were used to collect field data. Quantitative data was analyzed using SPSS which helped to generate descriptive statistics of frequencies and percentages while qualitative data was analyzed thematically. The results indicated that most teachers are not well prepared in the teaching of CCE content in senior secondary schools as 93.2% of teachers responded that they never attended any training for CCE. It was also revealed that most teachers did not use transformative teaching strategies such as projects, fieldtrips and case studies in the teaching of CCE content in senior secondary schools. It was therefore recommended that the Ministry of Education, Science and Technology (MoEST) should prepare teachers by training them on how they can teach CCE content. There is thus a need to have Continuing Professional Development Programs (CPDs) so that teachers can share knowledge and skills on the teaching of CCE content. Teachers' colleges and Universities should offer CCE courses to student teachers.

Keywords: Teacher preparedness; Climate Change Education; transformative teaching strategies; senior secondary schools; curriculum.

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Introduction

Climate Change (CC) is one of the most serious global concerns of our time that needs to be taught in schools as a matter of urgency (Mokaya et al., 2016). In Malawi, the evidence that CC is taking place is almost everywhere. For instance, the Southern Region of Malawi frequently experiences heatwaves, cyclones, floods and droughts. UNESCO (2021) recommended education as a powerful tool that can assist in addressing CC. If well taught, the students can be transformed and enabled to develop new knowledge, skills, values and attitudes in CC mitigation, adaptation and resilience.

To ensure effective implementation of Climate Change Education (CCE) in Senior Secondary School curriculum, teachers are expected to be well prepared (Muchanga & Nakazwe, 2015). As agents for change, teachers are supposed to use effective teaching methods and approaches which can assist learners to change their behaviors and take actions to combat CC. While learners arrive at school with many skills and interests, it is the teachers' responsibility to engage different learning styles to teach CCE content to meet the needs of the learners.

Although CC is not new, many people, including secondary school teachers, seem to know little about it (Malawi Institute of Education, 2015). The theories about CC are scientific in nature, hence most teachers do not understand them better. In the end, learners are not taught effectively because a teacher cannot effectively teach the content that he does not understand. Ronald et al. (2017) argued that the existence of CCE content in the curriculum does not mean that it is successfully delivered to learners because there are other factors that can may hinder its implementation. These factors include limited knowledge of teachers on how to teach the CCE content. In this study, the scholars examined the preparedness of teachers and the strategies the teachers used in the teaching of CCE in senior secondary schools in Malawi.

Climate Change Education in Malawi

Malawi is a signatory to several international conventions that address CCE and awareness, including the United Nations Framework Convention on Climate Change (UNFCCC) (Nhamo & Shava, 2014). 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. One of the ways of fulfilling this demand effectively and sustainably is through integrating CCE into the education system by infusing the CC content in all the subjects so as to achieve the country's aspirations and equip learners with climate change education knowledge (Joshua & Namphande, 2014).

In 2015, the former Minister for Natural Resources, Energy and Mining in Malawi, Mr. Bright Msaka launched a new CC sourcebook for secondary school teachers in collaboration with the UN Coordinator Ms. Mia Seppo (Malawi Institute of Education, 2015). The book was developed by the Malawi Institute of Education with support from the United Nations Climate Change Learning Partnership and the United Nations Development Program (UNDP). Despite this, the Malawi Institute of Education (2015) admitted that most secondary school teachers in Malawi have inadequate knowledge about CC because most teachers were not trained or prepared to teach the CCE content.

Theoretical Framework

This study was guided by the transformative learning theory which was developed by Jack Mezirow (Mezirow, 2009). Transformative learning is defined as learning that transforms problematic frames of reference (mindsets, habits of mind, meaning perspectives) to make them more inclusive, reflective, open, and emotionally able to change (Mezirow, 2009). Such frames of reference are better because they are more likely to generate beliefs and opinions in learners that will prove true or justified to guide action in the changing climate. Climate Change Education emphasizes the need for transformation at all levels of society, from individual to institutional and from local to global (UNESCO, 2020). The theory is important in guiding this study because to implement CCE curriculum in secondary schools, there is a need for teachers to have knowledge about CC and to use transformative methods of teaching that can help students change on how they view and interact with the environment.

The process of teaching CCE content should help students start doing things better, doing better things and finally see things differently. In line with this, UNESCO (2012) concurred that it is crucial to strengthen teachers' capacities to deliver accurate information, integrate local content, promote critical thinking through the use of appropriate

teaching and to take action on CC mitigation, adaptation and resilience.

Review of Literature

A survey of literature on different countries on teacher preparedness and the strategies employed in the teaching of the CCE content in secondary schools was done to ground the study on empirical evidence and experiences.

Teacher Preparedness

One of the important factors that may lead to effective teaching of the CCE content in secondary schools is teacher preparedness. Several studies have indicated that teacher education and teacher preparedness are a key to effective curriculum implementation as Mulenga and Ng'andu (2022); Mwanza and Mulenga (2018) and Mulenga (2018) rightly explained. Teachers are expected to provide learners with the right information and raise awareness on CC issues, hence a need for them to be well prepared and to understand the content better (Moshou & Drinia, 2023). Teachers who are well prepared through effective teacher education programs are likely to have skills and knowledge on how best they can teach the CCE content. Teachers who are not well prepared can easily misinterpret and pass on wrong information to the learners.

A study by Ndiritu et al. (2016) in Kenya revealed that secondary school teachers lacked knowledge and skills in the teaching of CC. No in-service teacher education about CCE was conducted due to inadequate funding. Curriculum developers in Kenya however explained that they conducted orientations long time ago in 2003 whereby few teachers got oriented and were expected to orient other teachers but this did not work out. Other curriculum experts in Kenya argued that it would be better to integrate the CCE content into pre-service teacher education programs rather than conduct in-service trainings (Ndiritu et al., 2016).

A study by Mubanga et al. (2022) in Zambia found that 75% of the teachers who taught subjects that contained elements of CC did not receive any form of CC education and training. Despite the majority of these teachers not receiving any education and training about CCE in their secondary schools and colleges, they were still required to teach elements of the subject as long as they were teaching subjects that included CC knowledge.

Furthermore, a study by Ekpoh and Jackson (2011) in Nigeria found a low level of awareness of CCE among secondary school teachers as teachers had limited knowledge about various CC elements such as global warming, ozone depletion, heat waves, flooding, windstorms, thunderstorm, landslide and mud flows. They were also not aware of the causes, effects and measures needed to be taken to adapt and mitigate the effect of CC. This called for immediate action to be taken so that teachers were well prepared about CCE.

In Malawi, despite the heavy effects of climate change, most secondary school teachers know little about CCE due to lack of education and trainings (Malawi Institute of Education, 2015). Only few teachers especially those who specialized in Geography in Teachers' Colleges and universities have knowledge about CCE and are likely to teach the content better. Some of the Universities in Malawi that offer CCE through Geography courses are Chancellor College, Domasi College of Education and Mzuzu University (Joshua & Namphande, 2014).

The only initiative that curriculum developers in Malawi did was to produce a CC source book for secondary school teachers. However, most secondary schools do not have the sourcebooks. The Malawi Institute of Education (2015) explained that teachers are direct agents of change, hence the need to be equipped with relevant knowledge and have enough resources in order to play an active, deliberate and effective role in the fight against CC through their teaching.

Strategies in the Teaching of Climate Change Education Content

Climate Change Education becomes more effective when teachers use transformative teaching strategies in the lessons (UNESCO, 2020). The availability of CCE content alone may not imply that it is successfully taught to the learners because if teachers use inappropriate teaching strategies, learners cannot learn properly (Ronald et al., 2017). Some of the effective and recommended teaching strategies for CCE include: projects, fieldtrips, experiments, case study, action learning and whole school approach.

Teaching using project method is very important for the implementation of CCE in secondary school curriculum (Larue et al., 2016). This method of teaching is based on the ideas of the great American educationalist, John Dewey who valued learning through practice (Larue et al., 2016). When learners

have learned about CC, they often want to take action in response to what they have become concerned about. Such projects may include making posters to raise awareness on CC, open a school garden where they can plant drought resistant crops, rainwater harvesting, waste management and run a recycling project at school.

In Canada, high school learners combined a project with community outreach as they conducted research on local CC and presented information in a video that was sent to schools in regions (Monroe et al., 2019). In Seychelles, about ten secondary schools organized a project for rain water harvesting as a means of adapting to water problems caused by CC (Larue et al., 2016). That was part of enhancing CCE in their secondary school curriculum by installing rainwater harvesting equipment such as water tanks and roof gutters.

Fieldwork is another teaching strategy that secondary school teachers can use when teaching the CCE content (Lotz-Sisitka et al., 2017). This is the method of teaching that provides opportunities for students to learn through direct and concrete experiences, thereby enhancing the understanding that comes from observing real world manifestations of abstract geographical concepts and processes. The involvement of learners in the learning process provided by fieldwork gives the learner sound and concrete basis for conceptualization and first-hand information which makes the learning CC more meaningful.

The transformative learning approach can be helpful in the teaching of the CCE content (UNESCO, 2015). The teaching of CCE content should assist learners to think critically and take action in CC mitigation and adaptation (Nhamo & Shava, 2014). On the contrary, the way most secondary school teachers in Malawi teach CCE content is transmissive and not transformative. Transmissive teaching approach is defined as the passing on of knowledge by the teacher to the learners while disregarding learners' lived experiences and contexts (Mtika & Gates, 2010). On the other hand, transformative teaching focuses on learners' lived experiences to change their behaviors and actions about the environment (Mezirow, 2009). Most teachers teach with the aims that they should finish the syllabus so that learners should pass examinations. Joshua and Namphande (2014) observed that transmissive style of teaching is usually a characteristic of an examination-oriented curriculum which encourages memorization and pays little attention to the application of knowledge.

The whole-school approach is also vital in the teaching of the CCE content. This approach is defined as an involvement of every aspect of school life in taking actions to reduce CC rates (Chopin et al., 2018). The approach has been widely encouraged for CCE, involving the entire school community which includes learners, teachers, administrators, parents and local community members (UNESCO, 2021). It involves engagement within and across the areas of school governance, teaching and learning, facilities and operations and community partnerships. The whole school approach is very important for addressing CC problems and demonstrating the urgent need for practical action (Chopin et al., 2018). Through this approach, community members may work together with schools in projects aiming at CC mitigation and adaptation such as planting tree seedlings and waste management.

Methodology

Design

This study employed a mixed method convergent parallel design. In this design, the researchers concurrently conducted the quantitative and qualitative elements equally at the same phase of the study. They analyzed the two data sets independently while interpreting the results together as per the assertion of Creswell and Plano Clark (2011). The integration of data in the convergent parallel design helped to have results and interpretations that were comprehensive as advised by Creswell and Plano Clark (2018). The researchers had an intermediate ontological position, acknowledging the fact that both objective and subjective views of the reality were useful.

Population and Sampling

Out of 223 secondary schools in 8 districts in the Southern Region of Malawi, 52 schools were sampled using a statistical formula $\mathrm{n} = \frac{n_0}{1+\frac{n_0-1}{N}}$. Out of the 52 schools, 26 were in Shire Highlands Education Division (SHED) in the following districts: Phalombe, Mulanje, Thyolo and Chiradzulu. The other 26 were in the South West Education Division (SWED) in the following districts: Blantyre, Mwanza, Chikhwawa and Nsanje. A sample of 422 participants consisting of 416 senior secondary school teachers, three inspectors of schools and three officers responsible for curriculum

development participated in the study. Homogenous purposive sampling was used in the selection of 8 teachers per school in each of the 52 schools as we chose a teacher from each of the following 8 subjects: Geography, Agriculture Science, Biology, English, Chichewa, Chemistry, Physics and Social Studies. This added up to a sample of 416 teachers. The 8 subjects were purposively chosen because they were taken by most students in senior secondary schools in Malawi. Homogenous purposive sampling was used in the selection of the three officers responsible for curriculum development in secondary schools and the three inspectors of schools. Each of the three officers responsible for curriculum development belonged to the departments of sciences, languages and humanities respectively. Similarly, each of the three inspectors of schools belonged to the departments of sciences, languages and humanities respectively.

Data Collection Instruments

The study used a questionnaire, a semi-structured interview guide and a lesson observation checklist as instruments for data collection. The questionnaires was distributed to 416 senior secondary school teachers. The items in the questionnaire were measured by a Likert scale (strongly agree, agree, not sure, disagree and strongly disagree). Data in the questionnaires was analyzed through descriptive statistics, using the SPSS software. The semi-structured interview guide was used as instruments for data collection from three officers responsible for curriculum development and the three inspectors of schools. An audio recorder was used for recording the interviews with permission from the participants. Data was transcribed by playing the recorder repetitively to ensure accuracy of data which was analyzed thematically. Lesson observations were also conducted to see the teaching strategies that teachers used in the teaching of the CC content.

Validity and Reliability

The researchers established the items' clarity and relevance to the study's objectives so as to ensure content validity. The use of multiple instruments in data collection, for instance, questionnaires, semi structured interview guide and lesson observation checklist helped to triangulate data and thus provided reliable information. The questionnaire was piloted to 46 teachers in six secondary schools within the SHED. Data from pilot study was analyzed using the SPSS and a Cronbach's Alpha of 0.8 was found which means that the questionnaire was reliable.

Table 1: Preparedness of Senior Secondary School Teachers to Teach Climate Change Education

		Agree		Not sure		Disagree			
Item		***f***	**%**	***f***	**%**	***f***	**%**	Total ***f***	Total **%**
1	I attended a training for Climate Change Education.	19	4.5	9	2.3	388	93.2	416	100
2	I attended Climate Change Education training during my teacher training at college or university.	23	5.5	28	6.8	365	87.7	416	100
3	We share knowledge and skills about Climate Change Education through Continuing Professional Development Program (CPD).	89	21.4	15	3.6	312	75	416	100
4	My school does not have enough teaching resources for Climate Change Education, for instance climate change sourcebooks and posters.	285	68.5	20	4.8	111	26.7	416	100
5	I avoid teaching Climate Change Education content due to my limited knowledge.	218	52.4	6	1.4	192	46.2	416	100

Ethical Considerations

Ethical requirements were complied with by obtaining research authorization from the ethical committee at the University of Zambia. The letters of permission were obtained from the SHED and SWED to allow the researchers to collect data from teachers in secondary schools. Informed consent was elicited from each respondent. All the

participants in the study were assured that the information they provided would be treated with almost confidentiality.

Results and Discussion

In this section, the result of the study are presented and discussed based on two research questions.

Research Question 1: To what extent are teachers prepared to teach Climate Change Education?

Through questionnaires, secondary school teachers were asked to indicate on a Likert scale about their preparedness to teach the CCE content. The results are shown in Table 1.

From Table 1, most teachers (93.2%) agreed that they did not have an education or training for CCE. Literature indicates that teachers who are not well prepared about CCE may lack knowledge and skills in the teaching of CC content and can easily misinterpret and pass on wrong information to the learners (Moshou & Drinia, 2023). Through interview, inspectors of schools revealed that most secondary school teachers have not had the CCE training and education. For instance Inspector Q1 said;

Most teachers have not attended any training about CCE due to inadequate funding. On the other hand, I would say, trainings were offered to few secondary school teachers about seven years ago with an aim that they should teach their fellow teachers in schools but this did not happen.

Similarly, the curriculum developers at the Malawi Institute of Education concurred with the inspectors of schools that most secondary school teachers were not trained in CCE due to inadequate funds from the government. For example a Curriculum Developer (C2) explained that; "What happened after developing the curriculum, we oriented few teachers about some changes that were made but the focus was not on CCE. The orientation was more of methodology in different topics rather than the teaching of CCE content."

These findings are not different from what Ndiritu et al. (2016) found in Kenya that secondary school teachers lacked knowledge and skills in the teaching of CCE content because they were not trained. Similarly, Ketlhoilwe and Kurusa (2015) found that teachers in secondary schools in Botswana did not have adequate knowledge and skills in teaching CCE content due to lack of training. This shows that the problem of lack of trainings and education about CCE is not only in Malawi but it seems to be a challenge in other countries in Africa. This implies that regional corporation is needed by ensuring that teachers are well trained in CCE as argued by Muchanga & Nakazwe (2015).

Data in Table 1 further shows that 87.7% of teachers disagreed that they attended trainings about CCE in colleges or universities. Most programs in colleges and universities in Malawi do not include CCE courses (Malawi Institute of Education, 2015). As earlier noted, only teachers of Geography have a chance of learning about CC in colleges and universities. This is not appropriate because all teachers are expected to have knowledge about CC so that they can be well prepared to teach the CCE content in all the subjects (UNESCO, 2021).

The results have also indicated that 75% of teachers disagreed that they had Continuing Professional Development (CPD) programs about CCE in their schools. This may not provide an environment where teachers share knowledge and skills on how best they can teach the CCE content. In South Africa, there is the Fundisa for Change Program where by teachers share knowledge in the teaching of the CCE content (Thenga et al., 2021). This program is said to have been very useful to teachers regarding the CCE understanding.

Results in table 1 further indicated that 68.5% of teachers agreed that their schools did not have enough teaching and learning resources for CCE. This is different from what the Malawi Institute of Education (2015) explained that they provided teaching and learning resources in secondary schools in Malawi such as CC sourcebooks. Muchanga and Nakazwe (2015) found a similar challenge of lack of teaching and learning resources in secondary schools in Zambia and recommended increased funding for CCE resources.

Research Question 2: What are teaching strategies used in the teaching of the Climate Change Education content?

The second research question sought to establish the teaching strategies used in the teaching of the Climate Change Education content in Malawi. Senior secondary school teachers were asked to indicate on a Likert scale regarding the strategies they used in the teaching of the CCE content as seen in Table 2.

Table 2: Strategies that Teachers Use in the Teaching Climate Change Education Content

Item		Agree		Not sure		Disagree		Total	Total
		f	%	*f*	%	*f*	%	*f*	%
1	Project	41	9.9	8	1.9	367	88.2	416	100
2	Field trip	83	20	4	1	329	79	416	100
3	Whole-school approach	87	20.9	15	3.6	314	75.5	416	100
4	Case study	96	23.1	12	2.9	308	74	416	100
5	Experiment	111	26.7	16	3.8	289	69.5	416	100
6	Dramatization	124	29.8	23	5.5	269	64.7	416	100
7	Lecturing	259	62.3	8	1.9	149	35.8	416	100
8	Action learning	138	33.2	27	6.5	251	60.3	416	100
9	Debate	149	35.8	25	6	242	58.2	416	100
10	Story telling	179	43	12	2.9	225	54.1	416	100
11	Future's thinking	190	45.7	9	2.1	217	52.2	416	100
12	Audit	173	41.6	28	6.7	215	51.7	416	100

Figure 1: Students Planting Tree Seedlings at Khongoloni Secondary School in Phalombe

Results in Table 2 indicate that most teachers (88.2%) disagreed that they used projects as a strategy of teaching CCE. This is not different from what was observed in the lessons, whereby out of 28 lessons that were observed, only one teacher used the project method in the lesson in which learners were planting tree seedlings to make their school climate friendly as shown in Figure 1.

Similarly, in a study that was conducted by Larue et al. (2016) in Seychelles, it was found that about ten secondary schools organized a project for rain water harvesting as a means of adapting to water problems caused by CC. This was one of the strategies for teaching CCE in schools which influenced learners and community members to change their behavior and take action for CC mitigation. Waste management projects can also be very important in schools as suggested by Makisa (2016) as was witnessed in the Copperbelt Province of Zambia. It is therefore necessary that secondary school teachers in Malawi be encouraged to use projects in the teaching of the CCE content.

From the results in Table 2, most secondary school teachers (79%) disagreed that they used fieldtrip as a strategy in the teaching of CCE content. Fieldtrips are a very practical and hands on way of teaching issue of CCE. UNESCO (2020) explained that field trips provides opportunities for students to learn through direct and concrete experiences, thereby enhancing the understanding that comes from observing real world manifestations of abstract

geographical concepts and processes. Moreover, fieldtrips brings the reality close to the subject being studied.

Behrendt and Franklin (2014) added that learners who directly participate during a field experience generate more practical solutions to local problems. For instance, in the topic on "Water pollution" which is included in senior secondary school curriculum in Malawi, learners can have a field trip to Mudi River in Blantryre district which is heavily polluted by chemicals from industries. Through direct experience, they can organize a big walk to the industries requesting them to stop polluting the river with chemicals which may have an impact on CC in future.

Findings in table 2 further indicated that 75.5% of teachers disagreed that they used whole-school approach in the teaching of CCE content. Once again not using this approach denies learners another opportunity to effectively learn about CCE in the curriculum. UNESCO (2021) argued that many issues about CCE cannot be solved by the school alone but require to build community partnerships whereby everyone should take action in CC mitigation, adaptation and resilience. For instance, this approach should involve learners, teachers, administrators, parents and local community members (UNESCO, 2020).

The results in Table 2 also show that most teachers (62.3%) agreed that they used lecturing in the teaching of the CCE content. This is similar to what was observed in the classroom because 16 out of 28 lessons were taught through lecturing. Teachers who mostly used this method focused on covering much content for learners to pass examinations. Ramakhula et al. (2014) found that most teachers in Lesotho teach learners for the purpose of passing examinations and not to apply what is taught for daily practices. They used traditional methods of teaching such as lecturing. This does not tally with the goal of increasing awareness on emerging and urgent global issues such CC (Nhamo & Shava, 2014).

Conclusions and Recommendations

Conclusions

The findings of the study led to a conclusion that most teachers were not well prepared to teach CCE in senior secondary schools. Furthermore, most teachers did not go through the Continuing Professional Development programs for CCE. It was concluded in the study that most schools did not have enough teaching and learning resources for CCE. Finally, most teachers did not use transformative teaching strategies such as project, fieldtrip and whole school approach in teaching CCE. This situation is not helpful in the implementation of the CCE in the secondary schools.

Recommendations

Based on the conclusions, it is recommended that the Ministry of Education, Science and Technology in Malawi should organize for CCE seminars and workshops for all teachers in secondary schools to enhance their effectiveness in teaching the CCE. Teachers' Colleges and universities should have compulsory CCE courses for all student teachers to enhance teachers' awareness and readiness to teach the CCE. Additionally, educational managers should introduce Continuing Professional Development programs about CCE in all secondary schools in Malawi. The Ministry of Education, Science and Technology should allocate enough funding for the purchasing or development of CCE teaching and learning resources. Finally, teachers should employ transformative teaching strategies such as project, field trip, whole school approach and case study to increase the effectiveness of CCE teaching and learning.

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