ARTICLE

Assessing high school learners' perceptions of climate change in Rwanda: Implications for education and advocacy

G. Chikomo[1] and T. Murwendo[2]

[1] Rwanda Basic Education Board, TTC Save, PO Box 97, Butare, Rwanda
[2]Department of Physics, Geography and Environmental Sciences, School of Natural Sciences, Great Zimbabwe University, PO Box 1235, Masvingo, Zimbabwe

guwachikomo@gmail.com https://orcid.org/0009-0006-6405-1837
dmurwendo@gmail.com / tmurwendo@gzu.ac.zw https://orcid.org/0000-0001-6861-2773

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ABSTRACT

Understanding high school learners' perceptions of climate change is important for climate scientists since they are the next generation of leaders, policymakers, and citizens who will be responsible for addressing and mitigating the impacts of future climate change. There are few studies on the knowledge and understanding of climate change by learners in Rwanda. This study's objectives are to assess the perceptions of high school learners in Gisagara District in Rwanda regarding climate change, and explore the implications for education and advocacy. A mixed-methods approach, combining closed and open-ended questionnaires, was used to gather quantitative and qualitative data from learners. Participants (n=251) were from six different high schools. Results of the study are that high school learners have varying perceptions of climate change and these are most strongly influenced by availability of resources on climate change, including from the internet, and personal motivation or interest in the topic. Suggestions from learners on how to increase understanding of climate change issues include prioritising climate change education within the school curriculum, incorporating real-life examples, interactive learning activities, and collaborative partnerships. Through effective education and advocacy strategies, young people can play a pivotal role in shaping policies, fostering behavioural changes, and raising awareness about the importance of addressing climate change for the well-being of both present and future generations.

Keywords: Climate change, Education and advocacy, Learners, Knowledge, Perceptions

INTRODUCTION

Understanding high school learners' perceptions regarding climate change is important as they represent future leaders and decision-makers who will drive future policies and actions to address climate change issues. Additionally, learners' understanding of climate change issues may foster environmental stewardship, promote sustainable practices, and ensure intergenerational equity (McLeod et al., 2024). Climate change is a contemporary pressing concern with a range of social and environmental consequences, where education is significant (Anser et al., 2023; Raihan, 2023), as many researchers have placed emphasis on the crucial role of education as a primary strategy for mitigating climate change (Busch et al., 2019; Lehnert et al., 2020). As a result, there is a need for information on the most effective approaches to involve, assist, and empower young people to adapt to and advocate for climate change (Hohenhaus et al., 2023). Climate change has a global impact, but many people in Africa lack a comprehensive understanding of its causes and the necessary actions to mitigate its effects (Haider, 2019). To address this issue, society must develop awareness about the causes, effects, and adaptive measures needed to combat the consequences of climate change (Malgwi & Joshua, 2021). This knowledge will provide individuals with the necessary guidance to act in an environmentally informed way (Eze, 2020) and impact their actions in climate change mitigation (Akhtar et al., 2018; Mustafa et al., 2019).

The effects of climate change are already being experienced particularly in African countries like Rwanda, and focus is needed for adaptation and resilience in the face of these changes. Present-day youth, despite bearing least responsibility for climate change, face the highest risk of becoming its casualties (Winograd, 2016). According to the World Health Organisation (2023), global youth are projected to endure over 80% of the harm, ailments, and fatalities resulting from climate change. This underscores the urgent need for accelerated global action, particularly in reducing greenhouse gas emissions and increasing climate finance (Boehm et al., 2022). As researchers work towards creating sustainable strategies to alleviate and adjust to these transformations, it is crucial to understand the perceptions and attitudes of different segments of society, including high school learners in countries like Rwanda.

The objectives of this study are to (1) assess the perceptions of high school learners in Gisagara District in Rwanda regarding climate change, and (2) explore the implications of these results for education and advocacy. The study will identify any misconceptions, knowledge gaps, and barriers that hinder active participation by learners in climate change-related issues.

LITERATURE REVIEW

Few studies have examined the perspectives of high school learners regarding climate change knowledge, and significant implications for education and advocacy efforts (Monroe et al., 2019; Kranz et al., 2022). Research on high school learners' perceptions of climate change highlight the need for education and advocacy to align with the Sustainable Development Goals (SDGs) (Mochizuki & Bryan, 2015). According to the SDGs, the 13th target is acquiring and implementing successful climate actions. Tunji-Olayeni et al. (2021) underscore the role of secondary school education in fostering climate change awareness and mitigation strategies, which are crucial in achieving successful climate action. Having an understanding of climate change and its effects through education is crucial, as it can influence learners' attitudes and future behaviours (Ghanbari et al., 2023). Therefore, schools have a vital role in advancing learners' understanding and responsibility about climate change mitigation, and assisting them in formulating strategies to address the challenges linked to climate change.

Learners in previous studies have perceived climate change as a significant threat, primarily caused by human actions, and are concerned about the increase in extreme weather events (Sanchez-Almodovar et al., 2022). In the USA, learners in public housing developments express feelings of neglect and complacency in addressing environmental change but also show concern for future generations (Tejada et al., 2020). Mebane et al. (2023) proposed a psychological intervention programme to increase learners' awareness of climate change. These findings underscore the need for comprehensive education and intervention programmes that address both knowledge and emotional aspects of climate change and empower learners to take action.

Schauss & Sprenger (2021) emphasise the importance of addressing uncertainties in climate modelling, which can impact learners' perceptions. Mutlu & Nacaroglu (2019) note that there are some misconceptions and a lack of understanding about potential solutions to climate change, particularly among gifted learners. In the USA, surveys conducted by Leiserowitz et al. (2011) and Roser-Renouf et al. (2020) revealed significant gaps in knowledge and misconceptions about climate change related to its causes, impacts and potential solutions. The findings highlight how these misunderstandings can affect individuals' perceptions, attitudes and engagement in climate action. Concern about climate change is often identified as a key motivating factor for engaging in pro-environmental behaviours and advocacy, as highlighted by Kolenatý et al. (2022). Furthermore, there have been extensive studies categorising learners and adults based on their level of climate change concern, ranging from being alarmed, concerned, and cautious to disengaged or dismissive (Crease & Singhasaneh, 2023). These studies have explored how the level of climate change concern influences pro-climatic behaviour (Kuthe et al., 2019; Leiserowitz et al., 2020; Kolenaty et al., 2022). These findings highlight the significance of tailored education and advocacy efforts to address these misconceptions and encourage environmentally friendly behaviours.

Ruiz et al. (2020) underscore the intricate nature of climate change perceptions,

identifying a range of drivers and their interactions, including principles and ideals, weather experience, community development, social interaction, and climate change information. In Latin America, there is a focus on addressing misconceptions and confusion about climate change, particularly among the youth through educational programs, interactive workshops, digital campaigns, peer-to-peer learning and community involvement (Castano & Paramo, 2020). This notion is reinforced by a comprehensive examination of climate change education in primary and secondary schooling, which highlights the increasing attention to this area and the focus on knowledge, behaviour, actions, experiences, and attitudes (Nepraš et al., 2022; Hohenhaus et al., 2023). The need for climate change to be integrated into quality education, particularly through Global Citizenship Education, is also emphasised (Roemhild & Gaudelli, 2021; Mbah, 2024). These studies collectively highlight the potential for education to shape learners' perceptions and actions toward climate change and sustainable development.

High school learners' perceptions of climate change are also influenced by their understanding of its local impacts and their sense of personal responsibility (Littrell et al., 2020; Mbah, 2024). Deshiana et al. (2022) posit that learners are aware of the effects of climate change and exhibit a positive attitude towards mitigating it, while Anderson (2024) notes that learners might know which actions might be most effective in mitigating climate change effects, but they do not necessarily do them.

Education functions as a fundamental societal element that enhances learners' knowledge, awareness, and attitudes towards climate change (Deshiana et al., 2022). Some learners have a better understanding of certain aspects, such as the causes and impacts of climate change, than others (Kwauk & Wintrop, 2021; Yen et al., 2021). This suggests a need for more comprehensive education on the topic because misunderstandings can lead to inaction. Akaygun & Adadan (2020) report that inquiry-based instruction can lead to an improved comprehension of climate change among learners.

High school learners assume a pivotal role in shaping the future response to climate change (Jones & Davison, 2021). Despite this significance, there is a lack of comprehension regarding high school learners' perceptions, knowledge and attitudes towards climate change, along with the factors influencing their involvement in climate education and advocacy. There are also few studies on knowledge and understanding of climate change in Rwanda (Taremwa et al., 2022). A nuanced understanding of these perceptions and implications is pivotal, as it will enable educators and advocates to tailor targeted interventions that not only educate but also empower high school learners, equipping them to effectively address the challenges posed by climate change.

METHODS

To achieve the objective of this study a mixed-methods approach was used since it combines both quantitative and qualitative methods to collect data. Six secondary schools in Gisagara District in the Southern Province of Rwanda were selected in this study. The sampled secondary schools had a combined enrolment of 5020 learners. Systematic

random point sampling was used whereby there were cards marked with letters A, B and C. The cards marked with the letter C were used as the research subjects. A total of 251 learners were chosen as research participants, in proportion to their total number across the schools. Data were gathered through hard-copy anonymous questionnaires. The questionnaire used a 5-point Likert scale for answers and also included both closed and open-ended questions. Questions focused on learners' knowledge and understanding of climate change. Thematic analysis was used for analysing qualitative data from open-ended questions from the questionnaire. Quantitative data generated was coded and assessed using the Statistical Package for Social Scientists (SPSS) and descriptive statistics.

In conducting this study, the ethics guidelines prescribed by Great Zimbabwe University for dealing with human subjects in research were strictly followed. Permission was granted from the relevant authorities and schools. Informed assent was given by participants. Ethical approval for the study was granted by Great Zimbabwe University.

RESULTS

Perceptions of high school learners regarding climate change

The participants indicated that they have a significant understanding of climate and its potential impact on the environment (Table 1).

Table 1: Participants' understanding of climate change and its impacts on the environment.

Category	Frequency	Percentage
Comprehensive understanding	177	74
Good understanding	61	26
Moderate understanding	0	0
Limited understanding	0	0
Not understanding at all	0	0
Total	**238**	**100**

In total, 74% of the learners said they have a comprehensive understanding of climate change, while 26% have a good understanding of it. There were no learners who indicated moderate, limited or not understanding climate change and its impacts. High school learners use different sources for gaining information about climate change (Table 2). The most common source of information was from teachers/educators (84%) compared to 58% from the internet or books. A total of 5% indicated alternative sources of climate change information, including personal observations and information from their parents.

Table 2: Sources of information regarding climate change by high school learners.

Category	Frequency	Percentage
Teachers/educators	200	84
Internet	137	58
Books and articles	137	58
Friends/peers	87	37
Others	12	5

The learners also considered the extent to which human activities contribute to climate change (Table 3). There was an overwhelming view that human activities are primarily responsible for climate change. Considerations on the perceived effects of climate change on future generations show that the learners are concerned about these effects overall but that there are some variable responses given (Table 4).

Table 3: Participants' regard of human activities as contributing to climate change.

Category	Frequency	Percentage
Very large extent	200	84
Large extent	38	16
Moderate extent	0	0
To a lesser extent	0	0
To no extent	0	0
Total	**238**	**100**

Table 4: Participants' perceptions about the effects of climate change on future generations.

Category	Frequency	Percentage
Very Severe	165	69
Moderately Severe	50	21
Neutral	23	5
Slightly Severe	0	0
Not Severe At All	0	0
Total	**238**	**100**

Initiatives to address climate change at school/communities

The study also sought participants' knowledge of any initiatives or actions being taken by their school or community to address issues of climate change. All learners indicated that they were aware of initiatives or actions being taken by their school or community in Gisagara District in Rwanda to address climate change. Examples of these initiatives include Green Amayaga, Green Gicumbi, monthly car-free day, tree planting activities and Umuganda.

Participants also considered the role that young people should play in addressing climate change. Their responses, among others, included participating in community efforts to mobilise tree planting and report environmental harm, as well as by joining environmental clubs and practicing the 4Rs (reuse, reduce, repair, and recycle). Other things mentioned included afforestation and reforestation, promoting proper waste management, engaging in climate change education initiatives, and informing the community and industry leaders about renewable energy and reducing CO_2 emissions. Influences on the potential actions undertaken by participants are shown in Table 5. Almost all participants agreed that the availability and accessibility of reliable information on climate change influence their views on this topic. However, there are more equivocal responses regarding the role of peer influence and social interactions, and discussion of climate change topics in the school curriculum.

Table 5: Participants' engagement in climate change education and advocacy initiatives. Key: SA: Strongly agree; A: Agree; N: Neutral; D: Disagree; SD: Strongly disagree.

Question	Responses (%)				
	SA	A	N	DA	SD
The availability and accessibility of resources and reliable information on climate change influence your engagement in climate change education and advocacy	225 (95)	13 (5)	0	0	0
Peer influence and social interactions have an impact on one's engagement in climate change and advocacy	113 (48)	125 (52)	0	0	0
The inclusion of climate change topics in the school curriculum influences your engagement in climate change education and advocacy	138 (58)	100 (42)	0	0	0
One's interests and motivations, such as the desire to make a positive impact on the environment or pursue a career in environmental fields, influence your engagement in climate change education and advocacy	198 (83)	40 (17)	0	0	0
Climate change education and advocacy initiatives can bring about change in your community	145 (61)	93 (39)	0	0	0

Implications of high school students' perceptions on designing educational strategies advocacy initiatives

High school students were asked their perceptions on designing educational strategies and advocacy initiatives that promote effective learning and social change (Table 6). These findings can inform educators and policymakers on how to create learner-centred and inclusive educational programs that empower young people to be active citizens. There was strong agreement that real-life examples and interactive learning approaches through community work can most effectively engage high school learners. Suggestions on how this can be done included establishing environmental clubs, expanding climate change chapters in schools, using ICT tools, field trips, and guest speakers. Additionally, involving learners in research, experiments, and environmental projects, as well as leveraging resources like the internet, books, and educators, can further engage them in climate change initiatives.

Table 6: Participants' responses on the implications of perceptions on climate change to inform the design of effective educational strategies and advocacy initiatives. Key: SA: Strongly agree; A: Agree; N: Neutral; D: Disagree; SD: Strongly disagree.

Question	Responses (%)				
	SA	A	N	DA	SD
Incorporating real-life examples and case studies in climate change education would enhance high school learners' engagement in advocacy initiatives	186 (78)	39 (16)	13 (6)	0	0
Interactive and experimental learning activities would be effective in fostering high school learners' understanding and involvement in climate change education and initiatives	224 (94)	0	14 (6)	0	0
Providing opportunities for high school learners to actively participate in community-based climate change projects would increase their motivation to engage in advocate initiatives	224 (94)	14 (6)	0	0	0
It is important to integrate interdisciplinary approaches, such as connecting climate change education with subjects such as science, social studies, and economics in designing effective educational strategies and advocacy initiatives	159 (67)	66 (28)	13 (5)	0	0
Fostering collaborative partnerships between schools, environmental organisations, and local communities would enhance the positive impact of climate change education and advocacy initiatives among high school learners	146 (62)	79 (33)	13 (5)	0	0

DISCUSSION

Perceptions of high school learners regarding climate change

Based on the results of this study, it can be observed that the majority of learners in the Rwandan high schools examined have a good understanding of what climate change is all about. This may reflect the fact that climate change is a cross-cutting issue in the Rwandan secondary school curriculum. These findings indicate that climate change is a well-understood one, but this is based only on the participant's own viewpoint of their knowledge. This aligns with Deshiana et al.'s (2022) findings in a similar study on Indonesian high school learners' awareness towards climate change. None of the learners selected responses indicating limited or no understanding of climate change.

The data gathered from participants regarding sources of information on climate change reveal that most learners primarily depended on their teachers/educators, along with the internet (Table 2). This is corroborated by the research conducted by Dorji et al. (2021), which revealed that teachers exhibit a higher level of awareness regarding the impacts of climate change. Desabayla & Gueta (2023) underscore the need for continued education through various sources, including the internet, television and schools, to improve learners' understanding and motivations to take action on climate change. Serantes-Pazos & Liotti (2020) describe the influence of school textbooks in shaping learners' perspectives on climate change, emphasising the need for more precise and timely information in these educational materials.

High school learners were concerned about the consequences of climate change for future generations (Table 4). Despite this, there are still misconceptions and biased understandings of climate change among high school learners, indicating a need for further education and awareness (Wu & Otsika, 2021). This is evidenced by the fact that only a small fraction of learners remained neutral, while others perceived the impacts of climate change to be more severe. The study findings indicate that high school learners are aware that human activities contribute to climate change (Table 3). The study findings indicated that the availability and accessibility to resources and reliable information on climate change influence learner's active engagement in climate change and advocacy (Table 5). It is crucial to involve high school learners in climate issues so that they play an active role in the strategies of this problem.

The study findings showed that high school learners were aware of climate change initiatives in their schools/communities and were often involved in these projects. Green Amayaga (in Southern Province of Rwanda) is a project being spearheaded by an NGO focusing on planting trees and offering alternative cooking stoves to local people in Gisagara District. Green Gicumbi (in Northern Province of Rwanda) has the same vision as Green Amayaga. Umuganda is a monthly national clean-up day designated to take place on the last Saturday of each month. Everyone is supposed to take part across the country. This finding aligns with the research conducted by Lopez & Malay (2019) which suggested that the awareness and positive attitude of senior high school learners towards climate

change issues is a positive indicator of their inclination to take action. This highlights the importance of schools and communities in actively addressing climate change.

A positive level of understanding and awareness among high school learners regarding climate change was shown from the study findings. Learners recognise the importance of taking action and are engaged in various initiatives to address this pressing issue. Such initiatives are crucial to the entire education system, especially in addressing issues of climate change that affect the global village. By educating learners on climate change, schools can help raise awareness and nurture a feeling of accountability towards the environment. Schools should play an active role in shaping learners' knowledge, attitudes and behaviours.

Implications for education and advocacy

Based on responses to the questionnaire, high school learners' perceptions have important implications for designing educational strategies and advocacy initiatives related to climate change. The majority of learners strongly agreed that incorporating real-life examples and case studies in climate change education would enhance their engagement in advocacy initiatives (Table 6). This indicates that practical and relatable examples can effectively capture learners' interest and motivate them to get involved. Sharitt et al. (2023) highlight the necessity for a more comprehensive approach to climate change education, which integrates the humanities and other global perspectives. Similarly, interactive and experimental learning activities were seen as effective in fostering understanding and involvement, with a high percentage of learners strongly agreeing with this statement.

The study findings showed that providing opportunities for learners to actively participate in community-based climate change projects was viewed as a way to increase their motivation to engage in advocacy initiatives (Table 6). This suggests that hands-on experiences and tangible actions can empower learners to make a meaningful impact. This corroborates previous studies that show that providing opportunities for learners to actively participate in community-based projects can significantly increase their motivation (Wodika & Middleton, 2020; Hilder & Collin, 2022; Damanik & Saliman, 2023; Gan et al., 2023). Integrating interdisciplinary approaches, such as connecting climate change education with Science, Social Studies, and Economics, was also recognised as important for designing effective strategies and initiatives (Table 6). This highlights the need for a holistic understanding of climate change and its interconnectedness with various disciplines.

Fostering collaborative partnerships between schools, environmental organisations and local communities was identified as another key consideration (Table 6). This supports Dunlop et al. (2021) who posit that education in schools is relevant to young people's participation in decision-making, educational policy, and practice. This indicates that involving multiple stakeholders and creating synergies can enhance the positive impact of climate change education and advocacy initiatives among high school learners.

Respondents provided various suggestions about efficient methods of imparting climate change knowledge to high school learners (Table 6). These ideas emphasise creating supportive environments, providing access to reliable information and resources, fostering experiential learning, and empowering learners to take action. Beach (2023) highlighted that teachers need to engage learners in activities to address the climate crisis. Implementing a combination of these strategies can effectively enhance climate change education and advocacy among high school learners. This is corroborated by Leichenko & O'Brien (2020), who suggest that a transformative approach to climate change education is necessary.

The study findings indicate that whilst high school learners were aware of climate change there were shortfalls that need to be addressed. This agrees with Wu & Otsika (2021) who found that high school learners in Shanghai, China, had misconceptions about climate change and that their knowledge and attitudes were weakly associated with behaviour. Educational institutions are challenged to equip learners and their prospective teachers with what is necessary for them to become multipliers for climate action (Winter et al., 2022).

CONCLUSIONS

The study focused on assessing local high school learners' perceptions of climate change and its implications for education and advocacy initiatives. The study concludes that learners in Gisagara District, Rwanda, are confident that they have a good understanding of climate change. In addition, learners indicated that they rely heavily on their teachers and the internet as primary sources of information on climate change. This underscores the critical role that educators play in shaping learners' understanding, and motivating them to take action. Additionally, the influence of textbooks and other educational materials is emphasised, reinforcing the need for these resources to provide accurate, up-to-date, and engaging information on climate change.

The study revealed that high school learners are generally concerned about the impacts of climate change, particularly on future generations, and that they are actively engaged in various school and community-based initiatives to address this issue. The study concludes that learners are willing to be involved in finding solutions, which should be further encouraged and supported through the education system. Therefore, by empowering learners and providing them with the necessary knowledge and tools, schools can play a pivotal role in fostering a generation of informed and proactive citizens who are capable of addressing the challenges of climate change.

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