



Teachers' Perceptions of Climate Change Education in Oman

Mohammed Abdullah Al-Nofli ^{a,*}, Osama Ragab Ibrahim ^b, Khalid Al Kalbani ^c

^a Faculty of Education and Arts, Sohar University, Sohar, Oman

^b Faculty of Engineering, Sohar University, Sohar, Oman

^c Ministry of Education, Muscat, Oman

* Corresponding author Email: mnofli@su.edu.om

DOI: <https://doi.org/10.54392/ajir2627>

Received: 09-10-2025; Revised: 12-04-2026; Accepted: 23-04-2026; Published: 06-05-2026



Abstract: Climate change is increasingly considered to be a global threat to the environment and human activities. Therefore, raising awareness of climate change and incorporating it into the educational curriculum is crucial. This study investigated social studies and science teachers' perceptions of various aspects of climate change education in Oman. Data were collected from 311 social studies and science teachers (Grades 5-12) using an online survey. The results showed that teachers agreed on many statements regarding climate change, including that climate change is happening; that human activities are the main cause of climate change, that there are risks of climate change for Oman, and that learning about climate change is important for students. The instructional methods most commonly used by teachers in both groups were discussion, current events, and small groups. On the other hand, the least used instructional methods were inviting climate experts/speakers to the classroom, field trips, and debates. Less emphasis was placed on certain teaching resources, such as geographical information systems and remote sensing. The study identified several challenges and opportunities related to teaching climate change. No statistically significant differences were found between social studies and science teachers' perceptions of climate change education except in terms of teaching resources and opportunities for teaching climate change, which were significantly higher among social studies teachers. The findings of this study offer valuable information for curriculum developers on climate change education.

Keywords: Climate Change Education, Environmental Education, Oman, Teacher Perceptions.

1. Introduction

Climate change is considered a global environmental threat, the consequences of which affect many aspects of sustainable development, such as human health, natural resources, food security, economic growth, and biodiversity (UNESCO, 2015). The World Meteorological Organization (2024) confirmed in a recent report on the state of global climate in 2023 that the concentrations of the main greenhouse gases continued to rise in 2023. The report also indicated that the global mean temperature was approximately 1.45 ± 0.12 °C above pre-industrial levels, making it the warmest year since records began. Moreover, the global mean sea level also reached a new record high in the same year, reflecting continued ocean heat. Many parts of the world have also been affected by extreme weather events, including heatwaves, heavy rainfalls, wildfires, shrinking glaciers, and tropical storms.

As an arid country, Oman is vulnerable to the potential adverse impacts of climate change, particularly with regard to increased temperatures, droughts, and desertification (Al-Kalbani, *et al.*, 2014; Choudri, *et al.*, 2013). Over the past two decades, Oman has been struck by several cyclones, most notably cyclones Gonu in 2007, Phet in 2010, Mukon in 2018, and Shaheen in 2021 (Al Kalbani & Rahman, 2022; Ragab *et al.*, 2022). Most recently, cyclone Shaheen contributed to unusual rainfall (294mm in 24 hours) in Al Suwiq, where almost three times the region's annual average was recorded (World Meteorological Organization, 2021; Ragab & Al Maghawry, 2024).

Beyond its effects on the environment, climate change presents Oman with serious socioeconomic problems. The agricultural sector has suffered from prolonged droughts and irregular rainfall patterns, which have decreased crop yields and increased reliance on imported food, endangering rural livelihoods and food security (Food and Agriculture Organization of the United Nations, 2018). Sea level rise and storm surges make coastal communities



more vulnerable, endangering infrastructure essential to the fishing and tourism sectors as well as important sources of employment and national revenue (Hereher *et al.*, 2020). Public budgets are strained and money from long-term development objectives is diverted to repair damage from extreme weather events like cyclones (Eckstein *et al.*, 2021). The socioeconomic resilience of Oman is challenged by these effects taken together, which also highlight the necessity of sustainable resource management and adaptive governance.

Since the 1992 United Nations Framework Convention on Climate Change, the global community has recognized the importance of education in responding to climate change (e.g., Raj & Amin, 2024; UNESCO, 2015; United Nations, 1992). UNESCO (2015) emphasized that climate change education (CCE) aims to help students to understand climate change in terms of the causes and consequences. Furthermore, it prepares students to live with the impacts of this global challenge and empowers them to take actions in order to adopt more healthy and sustainable lifestyles. Consequently, many countries around the world have begun to strengthen their K-12 educational programs in order to mitigate and adapt to climate change (e.g., Breatnach, *et al.*, 2022; UNESCO, 2015). Although formal education is central to the development of climate knowledge, several researchers have recognized the need for substantial educational efforts to support climate change in schools (e.g., Feldbacher, *et al.*, 2024; Mavuso *et al.*, 2021; Raj & Amin, 2024).

Growing interest in climate literacy has arisen over the last two decades. Oziewicz (2023, p. 34) defined climate literacy as “an understanding of the climate emergency—its facts, drivers, impacts, and urgency—that center on developing values, attitudes, and behavioral change aligned with how we should live to safeguard the Earth’s integrity in the present and for future generations”. One of the educational frameworks to support student learning of climate change is the Essential Principles of Climate Science, which outlines core scientific concepts that are important for students and the public (NOAA, 2009).

Traditionally, geography and science have been key subjects for the inclusion of topics on climate change. Geography in Omani schools is taught under the umbrella of social studies in grades three to 10. In grades 11-12, it is offered as an independent subject. Overall, there are direct references in the social studies curriculum to weather/climate, earth systems, global warming, green energy, and a range of environmental issues (Al-Nofli, 2018; Ministry of Education, 2024a). In relation to science, it is a compulsory school subject throughout the basic education grades (1-10). From grade nine to 12, science is divided into three discrete subjects: biology, chemistry, and physics. Apart from the depth of the science curriculum, students study a range of topics related to climate change, including living things, environments, water cycle, photosynthesis, sea level rise, food chains, pollution, ozone layer depletion, and types and effects of energy (Ministry of Education, 2024b).

Despite the importance of climate change, educational research on teaching and learning with regard to climate change in the Omani context remains scarce. For example, Al-Balushi and Ambusaidi (2015) found that research on environmental education, which comprises CCE, was among the least emphasized research topics in science education. Furthermore, Al-Nofli (2018) found that geography content included repeated topics across the textbooks for some grade levels (5-10), including the study of weather/climate, population geography, and some environmental issues (e.g., water deficit, soil depletion, and overgrazing) at the expense of other important topics such as climate change. The current curriculum framework emphasizes a wide range of concepts and themes that should be taught for students. In the environmental education domain, the framework focuses on several concepts related to climate change such as global warming, drought, desertification, Ozon layer, cyclones, and pollution (Ministry of Education, 2019). Therefore, engaging the teacher with different aspects of climate change in the Omani curriculum is critical.

Therefore, due to the increased interest in CCE, the current study aimed to investigate social studies and science teachers’ perceptions of some aspects of CCE in Oman. Specifically, the study sought to answer the following research questions:

- What are the perceptions of social studies and science teachers regarding climate change?
- What are the perceptions of social studies and science teachers regarding teaching climate change?
- What are the perceptions of social studies and science teachers regarding the challenges and opportunities associated with teaching climate change?



- Are there statistically significant differences between the perceptions of social studies and science teachers regarding climate change, teaching climate change, and the associated opportunities and challenges?

2. Literature Review

For several decades, the need for climate change in K-12 education has been noted. A fundamental aspect of CCE is the need for teachers who can have an impact on students' knowledge and understanding of climate change. Shulman's (1986, 1987) introduces domains of a teacher's knowledge base. Within his framework, teachers are required to develop several critical knowledge domains, including subject matter, pedagogical content knowledge [PDK], curriculum knowledge, and knowledge of learners. Shulman (1987) pointed out that PDK "represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented and adapted to diverse interests and abilities of learners, and presented for instruction" (P. 8). In this regard, the teacher uses her/his content knowledge to plan instruction based on various resources and assist students in attaining the knowledge, skills, and values most suited to their abilities and interests.

Overall, research studies have indicated that teachers view climate change as an important issue (Chang, 2023; Chowdhury *et al.*, 2021; Howard-Jones *et al.*, 2021). However, concerns have been noted across some international contexts that teachers are not well equipped to teach climate change (Abasto *et al.*, 2023; Chang, 2023; Mavuso *et al.*, 2021). For example, studies have highlighted that teachers hold misconceptions regarding climate change (Bhattacharya *et al.*, 2020; Chang, 2023). In their comprehensive review of teachers' conceptualization of climate change, Bhattacharya *et al.* (2020) identified a range of alternative conceptions of basic climate change concepts, including the ozone layer and greenhouse gases, the carbon cycle, and energy transfer. Indeed, Abasto *et al.* (2023) found no statistically significant difference between science and non-science teachers in terms of climate change knowledge.

In the teaching and learning of climate change, the literature supports the use of a wide range of active learning strategies, including group discussions, problem solving, investigation, and field trips (Feldbacher, *et al.*, 2024; Mngomezulu & Ramaila, 2025; UNESCO, 2015). Furthermore, based on a recent review of effective CCE, Monroe *et al.* (2017) identified four key strategies to teaching climate education: engaging students in reflective discussions; interacting with researchers and scientists; overcoming students' misconceptions; and implementing projects at school and community levels. Recognizing the importance of public and corporate actions in addressing the impacts of climate change, Field *et al.* (2023) argued for the analysis of economic and socio-political dimensions of climate change in the classroom.

Engaging students in effective climate change instruction requires the availability of a wide range of resources, including films, cartoons, maps, and interactive multimedia. In recent years, geo-spatial technologies such as geographical information systems [GIS], global positioning system, and remote sensing have become an essential part of teaching a wide range of environmental concepts and problems (Kerski *et al.*, 2013). Such technologies allow students to collect, store, analyze, interpret, and display data through a range of active learning strategies. Additionally, they serve as valuable resources for educating students about the climate changes affecting our planet over time, utilizing satellite images and change detection maps. Interestingly, Howard-Jones *et al.* (2021) found a positive correlation between teachers being comfortable delivering climate change and the reported availability of teaching resources.

However, researchers in many educational settings have identified several constraints on the effective implementation of CCE. For example, Wise (2010) found that while most science teachers in Colorado public schools in the United States showed support for teaching climate change, they nevertheless marginalized this topic or avoided teaching it. This suggests that the teachers were sensitive to the controversy surrounding climate change. Based on the Chinese context, Han (2015) found limited public and institutional support for CCE, insufficient awareness of the importance of CCE among key stakeholders, and inadequate preparation among pre-service and in-service teachers. Other constraints, identified by Odoom (2020) in Ghana, included teachers' limited knowledge and understanding of climate change, parental backgrounds of illiteracy and poverty, and a lack of the necessary educational resources in schools to support CCE. As with other contexts, there are several challenges facing the effective implementation of



CCE in Oman, including a lack of teaching resources and difficulties in organizing field trips (Al-Nofli, 2013; Al-Nofli et al., 2023).

Given the importance of climate change, the present study adds to the existing literature by exploring the perceptions of a sample of Omani social studies and science teachers regarding CCE. Understanding teachers' perceptions of CCE will help to improve the teaching and learning of this vital topic in Omani schools.

3. Methodology

3.1 Participants

The population of the study involved two groups of social studies and science teachers in basic education (Grades 5-10) and post-basic education (Grades 11-12). This population comprised 6065 teachers distributed in all governorates in Oman. A stratified sample of 700 (11.5%) social studies and science teachers were invited to participate in this study. The stratification was based on school subject ensuring that adequate representation is covered in the sample. They were contacted through their school districts. Of this sample, 311 social studies and science teachers responded to an online survey, giving a response rate of 44.4%.

3.2 Measure

The study utilized an online survey to explore teachers' perceptions regarding certain aspects of CCE in Oman. The survey was comprised of six sections: demographics; perceptions of climate change; perceptions of teaching climate change (including the importance of teaching some aspects of climate change, the teaching methods and resources used in teaching climate change, and preferred school levels and grade levels in which to teach climate change); teachers' sources of climate change; challenges to teaching climate change; and opportunities for teaching climate change. The survey items were developed based on personal educational experience as well as the related literature (Ballantyne, 1999; Field, et al., 2019; Newall & Patino, 2019). For example, section two of the survey included common statements about participants' agreement on climate change. The statements were similar to those mentioned in public and educator perception surveys about climate change (Field, et al., 2019; Newall & Patino, 2019).

A panel of eight educators specialized in geography, curriculum and instruction reviewed the survey, and modifications were made on the survey as a result of their comments. For example, misinformation circulating about climate change on social media was added in challenges to teaching climate change. Other comments were made on teaching practices in schools, such as the difficulty in teaching climate change issues and the lack of practical applications in climate change teaching. On teaching resources, it was recommended to include geographic information systems and remote sensing in teaching resources. The survey was pilot tested with a group of social studies and science teachers. Feedback on the wording of some statements and clarity of directions was taken into account in revising the survey. The reliability of the survey was assessed using Cronbach's alpha and ranged from 0.746 to 0.963 (Table 1). These values were considered acceptable for data collection.

Table 1. Cronbach's alpha for the scale

Section	# of items	Cronbach's alpha	# of participants
Perceptions of climate change	12	0.746	311
The importance of teaching some aspects of climate change	7	0.874	305
Teaching methods used to teach climate change	13	0.866	309
Resources used in teaching climate change	12	0.890	309
Challenges to teaching climate change	10	0.864	311
Opportunities for teaching climate change	13	0.963	311
Scale	67	0.927	311



3.3 Procedures

This study was carried out during the second semester of the academic year 2023/2024, having gained the approval of Sohar University and the Ministry of Education. Teachers participated voluntarily in this study and responded anonymously to an online survey. The normality of the distribution of the data has been checked using skewness and kurtosis methods. Skewness ranged from -0.098 to 0.062 and kurtosis ranged from -0.294 to 0.329 , which are within the range of normal distribution (Kim, 2013). Data analysis included descriptive statistics, such as means and standard deviations. Independent t -tests were performed to test the significance of differences between social studies teachers and science teachers in terms of their perceptions of some aspects of the survey. Cronbach's alpha coefficients were performed to test the reliability of key sections of the survey.

4. Results

This section includes the participants' demographic characteristics as well as their perceptions of CCE in Oman.

4.1 Demographics

Of the 311 participants in this study, 199 (64%) were social studies teachers. Most of the participants were males (51.4). Table 2 shows the demographic characteristics of the participants.

Table 2. Demographics of participants

Description	No. of participants	Percentage
<i>Subject</i>		
Social studies (geography & history)	199	64
Science (Biology, Chemistry, & Physics)	112	36
Total	311	100
<i>Gender</i>		
Male	160	51.4
Female	151	48.6
Total	311	100
<i>Qualification</i>		
Bachelor	193	62.1
Bachelor and Diploma Certificate in teaching	92	29.6
Master	22	7.1
PhD	4	1.3
Total	311	100
<i>Years of teaching experience</i>		
Less than 5	52	16.7
5-10	27	8.7
11-15	58	18.6
More than 15	174	55.9
Total	311	100
<i>School level</i>		
Basic education (Grades 5-10)	137	44.1
Basic education (Grades 5-10) and post-basic education (Grades 11-12)	94	30.2
Post-basic education (Grades 11-12)	80	25.7
Total	311	100



4.2 Perceptions of Climate Change

The second section asked participants to indicate their level of agreement with 13 statements about climate change, using a five-point Likert scale. Participants were required to demonstrate their responses along a range from one (disagree) to five (strongly agree). Overall, the social studies and science teachers agreed on many statements, including those that indicated that climate change is happening, that human activities are the main cause of climate change, that risks of climate change exist in Oman, and that CCE is important for students (Table 3). With regard to the statistical differences, Levene's test indicated no significant variance difference $F(2, 309) = .822, p = .365$. Independent t-tests showed no statistically significant differences in the perceptions of climate change between social studies teachers and science teachers ($t = .941, df = 309, p = .347, d = 0.11$).

Table 3. Teachers' perceptions of climate change

Statements	Social studies teachers		Science teachers		All teachers		% Agree & strongly agree
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
I am certain that climate change is happening.	4.407	0.569	4.312	0.616	4.373	0.587	95.1
I'm really worried about climate change.	3.879	0.879	3.732	0.87	3.826	0.877	73.4
I believe that human activities are the main cause of climate change.	4.266	0.755	4.08	0.912	4.199	0.818	84.2
There are risks of climate change in Oman.	4.111	0.673	3.991	0.691	4.068	0.681	85.2
Climate change reduces the quality of life for future generations.	3.844	0.865	3.875	0.95	3.855	0.895	72.4
The effects of climate change can be reduced.	4.035	0.670	4.098	0.657	4.058	0.665	85.2
Studying climate change is important for students.	4.417	0.621	4.286	0.728	4.370	0.664	93.5
The education system in Oman provides students with sufficient knowledge related to the effects of climate change on the local and global environment.	3.492	0.948	3.625	0.902	3.540	0.932	59.2
I have sufficient knowledge and skills to teach climate change.	3.884	0.799	3.741	0.878	3.833	0.83	73.9
I can influence students' behavior towards climate change.	3.930	0.632	3.839	0.717	3.897	0.664	78.7
Students ask questions about climate change in class.	3.573	0.890	3.598	0.905	3.582	0.894	63.4
My school has sufficient educational resources to teach climate change.	3.176	0.890	3.295	0.866	3.219	0.882	41.8

4.3 Perceptions of Teaching Climate Change

This section focused on teachers' perceptions of the importance of teaching some aspects of climate change, as well as the instructional methods used to teach climate change, the teaching resources used to teach climate change, the most appropriate school subjects in which to teach climate change, and the appropriate grade levels in which to teach climate change.

4.3.1. Importance of Teaching Some Aspects of Climate Change

The participants were asked to indicate the importance of teaching some aspects of CCE. Participants were required to indicate their responses on a scale from one (unimportant) to five (very important). As can be seen in



Table 4, teachers in both groups rated all of the statements as important, including raising awareness of climate change issues and encourage participation in climate change mitigation projects at the school and community levels. Levene's test was computed with no significant difference $F(2, 309) = .477$ $p = .490$. The independent t-test showed statistically significant differences between the social studies teachers and the science teachers in terms of their views of the importance of the statements ($t = 2.212$, $df = 309$, $p = .028$, $d = .26$), with social studies teachers indicating greater importance. The effect size is small between the two groups.

Table 4. Teachers' perceptions of the importance of teaching some aspects of climate change

Statements	Social studies teachers	Science teachers	All teachers	Social studies teachers	Science teachers	All teachers	% Important & very important
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Developing knowledge related to climate change (scientific concepts, causes of climate change, effects of climate change, etc.).	4.291	0.671	4.161	0.665	4.244	0.671	88.8
Raising awareness of climate change issues.	4.377	0.631	4.259	0.64	4.334	0.636	92.3
Encourage student participation in climate change mitigation projects at the school and community levels.	4.342	0.647	4.277	0.603	4.318	0.631	93
Developing environmental attitudes and values.	4.492	0.54	4.348	0.581	4.441	0.558	96.8
Promoting the adoption of lifestyles that are compatible with climate change.	4.296	0.626	4.17	0.656	4.251	0.639	94.4
Teaching field work skills (such as data collection, use of technologies, data analysis, etc.).	4.302	0.689	4.161	0.679	4.251	0.687	87.8
Help develop solutions to climate change.	4.312	0.677	4.152	0.661	4.254	0.674	89.4

4.3.2. Instructional Methods Used to Teach Climate Change

Participants were then asked about the instructional methods they used to teach climate change. They were required to indicate their responses on a scale from one (never) to five (always). As indicated in Table 5, the instructional methods most commonly used by teachers in both groups were discussion, current events, and small groups. On the other hand, the least used instructional methods were inviting climate experts/speakers to the classroom, field trips, and debates. Results of Levene's test indicated no significant difference $F(2, 309) = .411$ $p = .522$. Independent t-tests showed no statistically significant differences between social studies and science teachers in terms of their use of instructional methods ($t = 1.830$, $df = 309$, $p = .068$, $d = 0.22$).

4.3.3. Teaching Resources

Participants were asked about the teaching resources that they used to teach climate change. They were asked to indicate their responses on a scale from one (never) to five (always). In both groups, teachers reported that the most frequently used teaching resources were school textbooks, videos, maps, and other resources available



on the Internet. Conversely, the least used teaching resources were remote sensing, geographic models, and GIS (Table 6). With regard to the statistical analysis, Levene's test showed no significant difference $F(2, 309) = .410$ $p = .522$. Independent t -tests showed statistically significant differences between social studies and science teachers in terms of their use of resources ($t = 6.737$, $df = 309$, $p = .001$, $d = .79$), favoring social studies teachers. The results showed a large effect size in the utilization of resources by social studies teachers in comparison to science teachers.

Table 5. Instructional methods used by teachers

Instructional methods	Social studies teachers		Science teachers		All teachers		% often & always
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Discussion	3.849	0.898	3.786	0.895	3.826	0.896	65.6
Lecture	3.051	0.994	3.098	0.92	3.068	0.966	32.7
Debate	2.603	1.044	2.545	0.919	2.582	1.000	18.3
Current events	4.201	0.899	3.286	0.963	3.871	1.021	65.9
Case study	3.030	1.044	2.607	1.034	2.878	1.059	26.4
Teaching small groups	3.367	1.035	3.384	1.016	3.373	1.027	44.4
Inquiry	3.281	0.991	3.482	1.04	3.354	1.011	43.1
Role playing	3.08	1.007	2.955	0.99	3.035	1.001	28.3
Simulation	2.95	1.048	3.107	1.008	3.006	1.035	29.2
Field trips	2.281	1.006	2.161	1.027	2.238	1.013	10.3
Student projects in school/ community	2.754	1.061	2.705	1.062	2.736	1.060	21.5
Inviting climate experts/speakers to the	2.216	1.141	2.036	1.048	2.151	1.110	11.6
Campaigning	2.774	1.148	2.509	1.04	2.678	1.116	22.2

Table 6. Teaching resources used by teachers

Teaching recourses	Social studies teachers		Science teachers		All teachers		% often & always
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Educational games/interactive materials	3.035	1.084	2.973	1.078	3.013	1.081	31.5
Resources available on the	3.869	0.944	3.580	0.897	3.765	0.937	63.8
Newspapers/magazines	2.920	1.070	2.554	1.030	2.788	1.069	22.2
Instructional video	4.095	0.908	3.679	1.024	3.945	0.971	70.7
School textbook	4.307	0.889	4.036	1.056	4.209	0.960	80.1
Worksheets	3.050	1.184	3.250	1.086	3.122	1.152	37.3
Maps	4.266	0.907	2.893	1.158	3.772	1.201	64
School atlas	3.864	1.038	2.223	1.243	3.273	1.365	49.5
GIS	3.056	1.145	2.243	1.130	2.765	1.199	27
Remote sensing	2.678	1.250	2.045	1.017	2.450	1.209	19.9
Geographic models	2.839	1.174	2.107	1.060	2.576	1.186	20.5
Social networks	3.492	1.068	3.134	1.119	3.363	1.098	44.1

4.3.4. Appropriate School Subjects in Which to Teach Climate Change

In this part, participants were asked to indicate the most appropriate school subjects in which to teach climate change. Most teachers chose more than one subject. As can be seen in Figure 1, the school subjects rated highest in this respect were geography (18.53%), followed by environmental science (17.52%), social studies (16.98), and science (13.57%). The results highlighted the importance of geography/social studies and science subjects for teaching climate change.

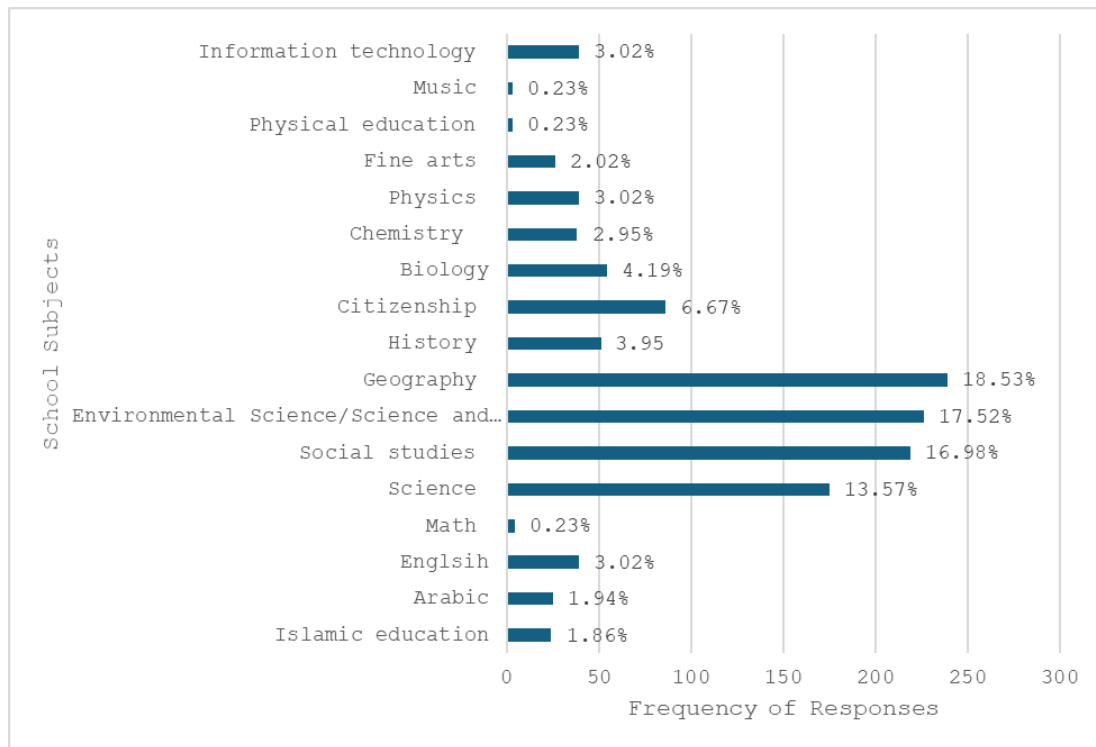


Figure 1. Appropriate school subjects in which to teach climate change

4.3.5. Appropriate Grade Levels in Which to Teach Climate Change

Participants were then asked to indicate the most appropriate grade level in which to teach climate change. Most teachers chose more than one level. As indicated in Figure 2, the most appropriate grade levels chosen by both social studies teachers and science teachers were second cycle (Grades 5-10) (37.83%), followed by all grade levels (30.09%), and post-basic education (Grades 11-12) (26.77%). These results indicate that the participants prefer to teach climate change across all grades.

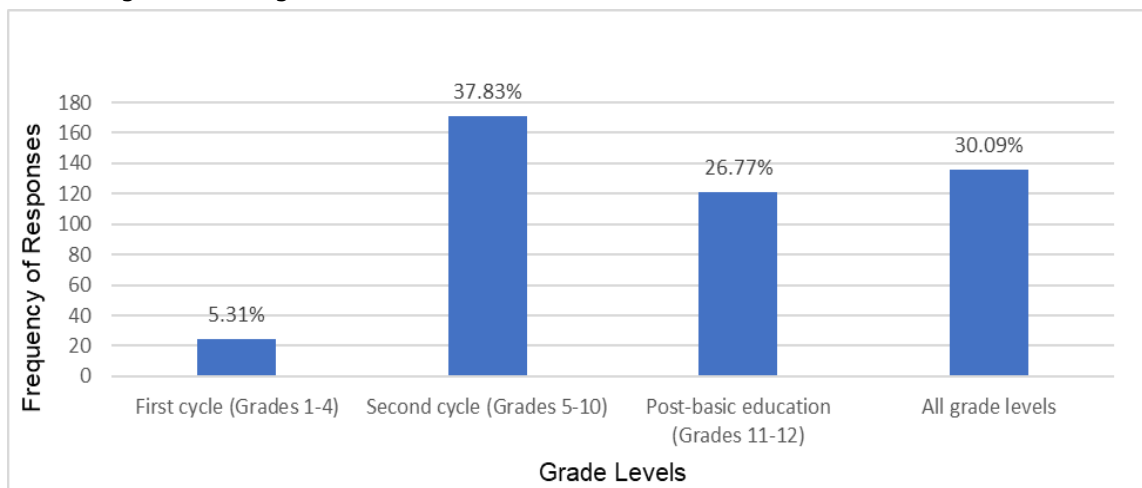


Figure 2. Appropriate grade levels in which to teach climate change



4.4 Teachers' Sources of Information about Climate Change

When asked about their sources of information regarding climate change, most teachers indicated more than one source of information. The most frequently mentioned sources were social networking sites (17.19%), followed by specialized websites on the Internet (16.78%), and television/radio (14.78%) (see Figure 3). Despite the importance of in-service professional development for teachers, it was not among the top teachers' sources of information about climate change. This requires greater attention by the Ministry of Education to enhance in-service professional development in relation to climate change.

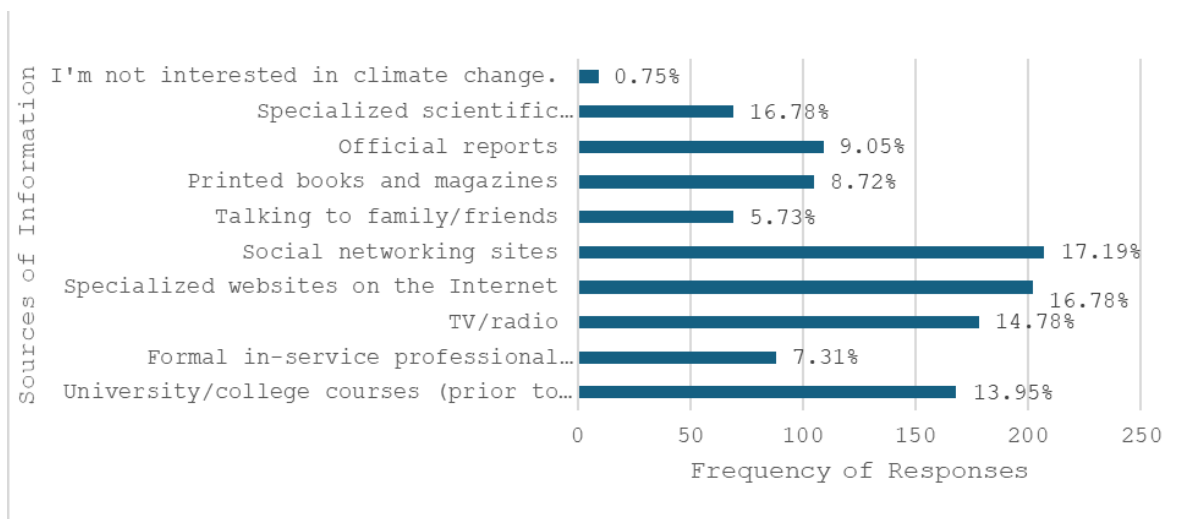


Figure 3. Teachers' sources of information about climate change

4.5 Challenges to Teaching Climate Change

Participants were asked in this section to indicate some of the challenges they faced in teaching climate change. Responses ranged from one (not a challenge) to five (very challenging).

Table 7. Teachers' perceptions of challenges to teaching climate change

Challenges	Social studies teachers		Science teachers		All teachers		% Challenging & very Challenging
	M	SD	M	SD	M	SD	
Lack of educational resources that help to teach climate change (e.g. educational films, specialized books/magazines, etc.).	3.075	1.044	3.134	0.982	3.096	1.021	32.1
Lack of professional development opportunities for teachers on climate	3.231	1.052	3.241	0.952	3.235	1.016	35.7
Lack of knowledge about climate change among teachers.	3.065	1.00	3.098	0.827	3.077	0.940	27.9
Lack of time devoted to teaching climate change.	3.271	1.062	3.232	0.870	3.257	0.996	38.9
Difficulty of teaching climate change-related topics.	2.593	1.146	2.607	0.904	2.598	1.064	16.1
Lack of practical applications in teaching climate change topics.	3.136	1.066	3.036	0.816	3.100	0.984	31.2
Lack of support from the ministry/directorate for teaching climate	3.437	1.084	3.268	0.910	3.376	1.027	42.8



The school curriculum does not include topics on climate change.	3.206	0.991	3.036	0.949	3.145	0.978	29.6
Lack of support from environmental groups for teaching climate change.	3.402	1.123	3.277	1.050	3.357	1.098	42.5
Misinformation circulating about climate change on social media.	3.276	1.024	3.277	0.903	3.277	0.981	36.3

As can be seen in Table 7, the greatest challenges facing social studies teachers and science teachers were reportedly a lack of support from the ministry/directorate, followed by a lack of support from environmental groups, and a lack of time allocated to teaching climate change. The variances between the groups were not significant $F(2, 309) = 2.706$ $p = .101$. Independent t -tests showed no statistically significant differences between the two groups with regard to the challenges they face in teaching climate change ($t = .609$, $df = 309$, $p = .543$, $d = 0.07$).

4.6 Opportunities for Teaching Climate Change

Finally, the last section asked participants to rate the importance of having opportunities for teaching climate change in their schools. They were asked to indicate their responses on a scale from one (unimportant) to five (very important).

Table 8. Teachers' perceptions of opportunities for teaching climate change

Opportunities	Social studies teachers		Science teachers		All teachers		% Important & very important
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Provision of educational resources in schools that help to teach climate change (educational films, specialized books/magazines, etc.).	4.095	0.967	3.946	0.976	4.042	0.971	73.3
Participation in seminars and conferences related to climate change.	4.065	0.98	3.679	0.922	3.926	0.976	70.8
Conducting field trips.	4.116	0.949	3.83	0.948	4.013	0.957	73.4
Partnership with community institutions interested in climate change (environmental associations, government institutions, scientific centers, parks/gardens, etc.)	4.06	0.936	3.821	0.942	3.974	0.943	74
Climate change topics being included in pre-service teacher education programs.	3.97	1.029	3.473	1.082	3.791	1.074	66.3
Climate change topics increasing in the subject that I teach.	3.99	0.99	3.393	1.118	3.775	1.075	66.9
Climate change being taught in all subjects.	3.583	1.116	3.134	1.182	3.421	1.158	51.1
Provision of government policies and documents related to climate change.	3.93	1.032	3.464	1.03	3.762	1.054	63.7
Provision of climate data at the national and global levels.	3.995	0.946	3.643	1.021	3.868	0.986	69.2
Provision of tools and technologies that help study climate change.	4.065	0.964	3.804	0.879	3.971	0.941	74.6
Increased teacher participation in groups interested in studying climate change.	4.005	0.956	3.634	0.94	3.871	0.965	69.1



Organizing student competitions related to climate change.	3.99	0.974	3.759	0.893	3.907	0.951	72.3
Increased support from environmental and professional associations.	4.03	1.015	3.866	0.935	3.971	0.988	73.3

Participants indicated the importance of a range of opportunities (Table 8), including providing schools with educational resources (e.g., educational films, specialized books/magazines, etc.), followed by conducting field trips, partnership with community institutions interested in climate change (e.g., environmental associations, government institutions, scientific centers, parks/gardens, etc.), and increasing support from environmental and professional associations. Levene's test showed no significant difference $F(2, 309) = .056$ $p = .814$. Results of independent t-tests revealed statistically significant differences between social studies teachers and science teachers in terms of their perceptions of the importance of opportunities for teaching climate change ($t = 3.520$, $df = 309$, $p = .001$, $d = .41$), favoring social studies teachers. The effective size is small to moderate effect.

4. Discussion

The current study was undertaken to investigate the perceptions of social studies teachers and science teachers with regard to some aspects of CCE in Oman. Despite a moderate response rate (44.4%), it is significant to highlight that our participants were from all school districts in Oman, with most (59.8%) having over 15 years of experience in teaching. Thus, these findings are particularly relevant and useful for helping to develop future activities and resources for teaching climate change.

Participants in both groups acknowledged that climate change is happening, and recognized anthropogenic climate change. These findings are in line with the widespread views of teachers on climate change in many educational settings (e.g., [Ambusaidi et al., 2012](#); [Bevins, 2020](#); [Field, et al., 2019](#); [Howard-Jones, et al., 2021](#); [Newall & Patino, 2019](#)). At the same time, the participants supported teaching all aspects of climate change, including developing environmental attitudes and values, raising awareness of climate change, and encouraging students' participation in climate change mitigation projects. There were no statistically significant differences between social studies teachers and science teachers in this regard. Overall, the results show that both social studies and science teachers are in favor of the inclusion of climate change education.

When asked about teaching methods, the participants reported using a wide range of teaching methods, including current events, discussion, small groups, and inquiry, which reflect student-centered approaches. However, other important teaching methods and strategies—such as field trips, inviting climate experts/speakers to the classroom, projects in school and community, and campaigning—receive little attention in social studies and science classes, according to the respondents. Given the strengths of these strategies, which are considered among the most effective ([Feldbacher, et al., 2024](#); [Monroe et al., 2017](#)), this finding is somewhat surprising. Interactions with scientists, for example, stimulate learners' interests in scientific inquiry, particularly if there are opportunities for learners to visit a laboratory ([Monroe et al., 2017](#)). Additionally, teaching climate change can be powerful by implementing interdisciplinary, student-centered, innovative, and affect-driven approaches ([Rousell & Cutter-Mackenzie-Knowles, 2020](#)). The Ministry of Education should promote a wide range of active learning strategies in schools. This can be through student participation in climate change projects such as tree planting and recycling, as well as promoting climate change awareness in the community. This will help students make sense of what they are learning in school and take the right actions.

Although most participants supported teaching climate change across all grade levels, they collectively agreed that geography, science, and general social studies are the optimal school subjects in which to teach climate change. Ascribing climate change to particular school subjects, as viewed by Omani teachers, contradicts the cross-curriculum approach to teaching climate change (e.g., [Howard-Jones, et al., 2021](#); [UNESCO, 2015](#)).

With regard to the challenges related to CCE, most participants recognized the need for support from the Ministry of Education and environmental groups when teaching climate change. Furthermore, another important challenge was noted in relation to the need for more time to be allocated for teaching climate change. In fact, insufficient time for teaching climate has been identified as an issue in several contexts such as England and Canada ([Field, et al., 2019](#); [Rushton & Walshe, 2025](#)). If Omani students are to have quality learning opportunities about



climate change, more instructional time is needed. Additionally, a lack of knowledge about climate change was regarded as a challenge to some degree ($M = 3.1$). In view of this finding, it is important to ensure that teachers are sufficiently equipped with the necessary scientific knowledge for teaching climate change in both pre-service and in-service teacher preparation. This can be through a range of workshops, seminars, and online courses, with a focus on core concepts and principles of climate change literacy such as understanding of Earth's climate, causes and impacts of climate change, and mitigation actions (NOAA, 2009). Although social networks are among the top sources for teachers' information about climate change (Figure 3), they also present a significant challenge due to misinformation. Given the complexity of climate change, it is vital for teachers to rely upon official sources in order to provide students with accurate information.

Additionally, the findings provided useful insights into the opportunities for teaching climate change. The major opportunity was related to the need for educational resources to teach climate change. Several previous studies have underscored the importance of having access to relevant resources to facilitate students' engagement in learning about the rapidly changing nature of the climate (Bhattacharya, *et al.*, 2020; Odoom, 2020). Also, the participants highlighted the importance of engaging in field trips for teaching climate change. Unsurprisingly, implementing field trip activities is regarded as a recurring teaching and learning opportunity in Omani schools (e.g., Al-Maamari, *et al.*, 2014; Al-Nofli, 2013). Among the other opportunities mentioned was a partnership with community institutions interested in climate change. A range of public and private institutions exist in various cities and communities around the country and can work with schools, including the Environment Authority, Environment Society of Oman, and natural reserve sites. In general, the findings on further opportunities for enhancing CCE are consistent with those in the literature, including increasing professional preparation opportunities for pre-service and in-service teachers (Abasto, *et al.*, 2023; Bhattacharya, *et al.*, 2020; Chang, 2023; Wise, 2010).

A limitation of the study is that there is a clear difference between social studies and science in terms of their importance in the Omani education system. For example, science has more class periods compared to social studies across all basic education grades (1-10) (Ministry of Education, 2024a; Ministry of Education, 2024b). In recent years, it has undergone a significant curriculum reform, with the introduction of Cambridge science textbook series across all grade levels. All these could have influenced teachers' perceptions of some aspects of CCE. In addition, the study relied on surveys as the only source of teachers' perceptions. There were no opportunities to conduct interviews with teachers, which could have benefited the findings of the study.

5. Conclusion

This study provided insights into various aspects of CCE in Oman. Overall, participants were positive in their views of CCE. Indeed, they supported all of the statements concerning climate change in terms of its existence, causes, and human activities contributing to these causes, as well as risks faced by Oman in this regard. Additionally, the participants agreed that all aspects of climate change should be taught and showed a commitment to implementing a wide range of instructional methods and resources in their own teaching. However, some concerns were raised regarding the lack of implementation of various active learning methods, including field trips, debating, and interacting with climate experts and specialists. Participants appeared less willing to integrate advanced technologies such as remote sensing, GIS, and geographic models into their lessons on climate change.

Interestingly, this study found no significant differences between social studies teachers and science teachers in terms of their perceptions of CCE with the exception of the resources used to teach climate change and perceptions of opportunities for teaching climate change, which were perceived to be greater according to social studies teachers. Moreover, the study identified various opportunities and challenges that require further attention in order to enhance CCE in schools; these include the need for more educational resources, greater professional development opportunities for teachers with regard to climate change, and increased support from public and private institutions. Despite the useful findings provided by this study, there remain opportunities for future research to further enhance our understanding of CCE in Oman. For example, how are pre-service and in-service teachers prepared for teaching climate change? In what ways do governmental and non-governmental organizations support CCE? It would be useful for future researchers to examine these questions in order to better inform teacher training programs and educational institutions with a view to further improving CCE in Oman.



References

- Abasto, V., Larrain, A., Vergara, C., Cofre, H. (2025). Alternative Conceptions About Climate Change in a Group of Teachers in Chile: Are Science Teachers More Knowledgeable Than Non-Science Teachers. *ECNU Review of Education*, 8(1), 144-160. <https://doi.org/10.1177/20965311231211013>
- Al Kalbani, K., Rahman, A.A. (2022). 3D City Model for Monitoring Flash Flood Risk in Salalah, Oman. *International Journal of Engineering and Geosciences*, 7(1), 17-23. <https://doi.org/10.26833/ijeg.857971>
- Al-Balushi, S.M., Ambusaidi, A.K. (2015). Science education research in the Sultanate of Oman: The representation and diversification of socio-cultural factors and contexts. In N. Mansour & S. Al-Shamrani (Eds.), *Science education in the Arab gulf states: Visions, sociocultural contexts and challenges*, Sense Publishers, 23-47. https://doi.org/10.1007/978-94-6300-049-9_2
- Al-Kalbani, M.S., Price, M.F., Abahussain, A., Ahmed, M., O'Higgins, T. (2014). Vulnerability Assessment of Environmental and Climate Change Impacts on Water Resources in Al Jabal Al Akhdar, Sultanate of Oman. *Water*, 6(10), 3118-3135. <https://doi.org/10.3390/w6103118>
- Al-Maamari, S., Al-Nofli, M., Al-Gharibi, Z. (2014). The State of Social Studies in Basic Education Schools in Oman. *Asian Social Science*, 10(7), 213–220. <http://dx.doi.org/10.5539/ass.v10n7p213>
- Al-Nofli, M.A. (2013). The State of Geography in basic Education Schools in Muscat, Oman. *International Research in Geographical and Environmental Education*, 22(2), 109–119. <http://dx.doi.org/10.1080/10382046.2013.778711>
- Al-Nofli, M.A. (2018). An Analysis of Geography Content in Relation to Geography for Life Standards in Oman. *International Research in Geographical and Environmental Education*, 27(1), 56-68. <https://doi.org/10.1080/10382046.2017.1285133>
- Al-Nofli, M.A., Alajmi, M.S., Al-Saeedi, M.S. (2023). Pre-Service Teachers' Reflections on Prior Experiences of Learning Social Studies. *International Journal of Learning, Teaching and Educational Research*, 22(9), 102-116. <https://doi.org/10.26803/ijlter.22.9.6>
- Ambusaidi, A., Boyes, E., Stanisstreet, M., Taylor, N. (2012). Omani Pre-Service Science Teachers' Views About Global Warming: Beliefs about Actions and Willingness to Act. *International Journal of Environmental and Science Education*, 7(2), 233-251.
- Ballantyne, R. (1999). Teaching Environmental Concepts, Attitudes and Behavior Through Geography Education: Findings of an International Survey. *International Research in Geographical and Environmental Education*, 8(1), 40–58. <https://doi.org/10.1080/10382049908667588>
- Bevins, P.A. (2020). Climate change is here: Teachers' and students' perceptions about education for it. *The University of Waikato*. <https://researchcommons.waikato.ac.nz/server/api/core/bitstreams/1e217332-8eb6-480b-91f5-88c2b8b57b51/content>
- Bhattacharya, D., Carroll Steward, K., Forbes, C.T. (2021). Empirical Research on K-16 Climate Education: a Systematic Review of the Literature. *Journal of Geoscience Education*, 69(3), 223–247. <https://doi.org/10.1080/10899995.2020.1838848>
- Breatnach, D., Moloney, M., Pope, J. (2021). Early beginnings: Fostering Positive Dispositions towards Climate Education in Early Years Classrooms. In *Teaching Climate Change in Primary Schools*, Routledge. 72-86.
- Chang, C.H. (2023). *Climate Change Education: Knowing, doing and being* (2nd ed.). Routledge. <https://doi.org/10.4324/9781003093800>
- Choudri, B.S., Al-Busaidi, A., Ahmed, M. (2013). Climate Change, Vulnerability and Adaptation Experiences of Farmers in Al-Suwayq Wilayat, Sultanate of Oman. *International Journal of Climate Change Strategies and Management*, 5(4), 445-454. <https://doi.org/10.1108/IJCCSM-11-2012-0061>



- Chowdhury, M.T.A., Ahmed, K.J., Ahmed, M.N.Q., Haq, S.M.A. (2021). How do Teachers' Perceptions of Climate Change Vary in Terms of Importance, Causes, Impacts and Mitigation? A Comparative Study in Bangladesh. *SN social sciences*, 1(7), 174. <https://doi.org/10.1007/s43545-021-00194-7>
- Eckstein, D., Kunzel, V., Schafer, L. (2021). Global climate risk index 2021: Who suffers most from extreme weather events? Weather-Related Loss Events in 2019 and 2000-2019. *Germanwatch*.
- Feldbacher, E., Waberer, M., Campostrini, L., Weigelhofer, G. (2024). Identifying Gaps in Climate Change Education - a Case Study in Austrian Schools. *International Research in Geographical and Environmental Education*, 33(2), 109-124. <https://doi.org/10.1080/10382046.2023.2214042>
- Field, E., Schwartzberg, P., Berger, P. (2019). Canada, climate change and education: Opportunities for public and formal education (formal report for learning for a sustainable future). *York University Printing Services*.
- Field, E., Spiropoulos, G., Nguyen, A., Grewal, R. (2023). Climate Change Education within Canada's Regional Curricula: A Systematic Review of Gaps and Opportunities. *Canadian Journal of Educational Administration and Policy*, (202), 155-184. <https://doi.org/10.7202/1099989ar>
- Food and Agriculture Organization of the United Nations. (2018). Country Programming. Framework for the Sultanate of Oman 2018 to 2022. *Food and Agriculture Organization of the United Nations*.
- Han, Q. (2015). Education for Sustainable Development and Climate Change Education in China: A status report. *Journal of Education for Sustainable Development*, 9(1), 62-77. <https://doi.org/10.1177/0973408215569114>
- Hereher, M., Al-Awadhi, T., Al-Hatrushy, S., Charabi, Y., Mansour, S., Al-Nasiri, N., Sherief, Y., El-Kenawy, A. (2020). Assessment of the Coastal Vulnerability to Sea Level Rise: Sultanate of Oman. *Environmental Earth Sciences*, 79(15), 369. <https://doi.org/10.1007/s12665-020-09113-0>
- Howard-Jones, P., Sands, D., Dillon, J., Fenton-Jones, F. (2021). The Views of Teachers in England on an Action-Oriented Climate Change Curriculum. *Environmental Education Research*, 27(11), 1660-1680. <https://doi.org/10.1080/13504622.2021.1937576>
- Kerski, J., J., Demirci, A., Milson, A.J. (2013). The Global Landscape of GIS in Secondary Education. *Journal of Geography*, 112(6), 232-247. <https://doi.org/10.1080/00221341.2013.801506>
- Kim, H.Y. (2013). Statistical Notes for Clinical Researchers: Assessing Normal Distribution (2) using Skewness and Kurtosis. *Restorative Dentistry & Endodontics*, 38(1), 52-54. <http://dx.doi.org/10.5395/rde.2013.38.1.52>
- Mavuso, M.P., Olawumi, K.B., Khalo, X., Kafu-Quvane, B., Mzilikazi, B. (2021). Implementation of Teacher Capacitation Programs to Integrate Climate Change Education: The Case Study of Geography Teaching in South African Secondary Schools. *International Journal of Learning, Teaching and Educational Research*, 21(11), 73-86. <https://doi.org/10.26803/ijlter.21.11.5>
- Ministry of Education. (2019). *General concepts in the curricula in the Sultanate of Oman*.
- Ministry of Education. (2024a). *Guidance bulletin for the social studies subject (3-12): Academic year 2023/2024*.
- Ministry of Education. (2024b). *Guidance bulletin for the science subject: Academic year 2023/2024*.
- Mngomezulu, H., Ramaila, Sam. (2025). Integrating Environmental Education into Grade 11 Life Sciences Classrooms: Challenges and Pedagogical Opportunities. *International Journal of Learning, Teaching and Educational Research*, 24(7), 376-401. <https://doi.org/10.26803/ijlter.24.7.19>
- Monroe, M.C., Plate, R.R., Oxarart, A., Bowers, A., Chaves, W.A. (2017). Identifying Effective Climate Change Education Strategies: A Systematic Review of the Research. *Environmental Education Research*, 26(6), 791-812. <https://doi.org/10.1080/13504622.2017.1360842>
- Newall, M., Patino, T. (2019). Teachers agree that climate change is real and should be taught in schools. *Ipsos*.
- NOAA. (2009). *Climate literacy: The essentials principles of climate science*. National Oceanographic and Atmospheric Administration https://scied.ucar.edu/sites/default/files/2021-10/climate_literacy_brochure.pdf



- Odoom, M. (2020). *Constraints and Contributing Factors to Implementing Climate Change Education as an Emerging Curriculum Area at the Basic Education Level in Cape Coast Metropolis. Ghana* (Doctoral Dissertation).
- Oziewicz, M. (2023). What is Climate Literacy? *Climate Literacy in Education*, 1(1), 34-
<https://doi.org/10.24926/cle.v1i1.5240>
- Ragab Ibrahim, O., Al Maghawry, S. (2024). A Comparative Analysis of Precipitation Estimates of Cyclone Shaheen and Al Azm trough using GPM-Based Near-Real-Time Satellite. *Arabian Journal of Geosciences*, 17(6), 192
<https://doi.org/10.1007/s12517-024-11972-x>
- Ragab, I.O., Al-Amir, M., Al-Maghawry, S. (2022). Tracking the Damages of the Shaheen Cyclone in the Sultanate of Oman. *Water Practice and Technology*, 17(12), 2548–2553. <https://doi.org/10.2166/wpt.2022.138>
- Raj, P.S., Amin, S.S. (2024). Climate Literacy in the Age of Global Climate Change: A Critical Inquiry into Shaping Climate –Literate Society for a Sustainable Future, *Asian Journal of Interdisciplinary Research*, 7(2) (2024), 1-11. <https://doi.org/10.54392/ajir2421>
- Rousell, D., Cutter-Mackenzie-Knowles, A. (2019). A Systematic Review of Climate Change Education: Giving Children and Young People a 'Voice' and a 'Hand' in Redressing Climate Change. *Children's Geographies*, 18(2), 191–208. <https://doi.org/10.1080/14733285.2019.1614532>
- Rushton, E. A. C., & Walshe, N. (2025): Curriculum making and Climate Change and Sustainability Education: a Case Study of School Teachers' Practices from England, UK. *Environmental Education Research*, 31(5), 1083–1097. <https://doi.org/10.1080/13504622.2025.2471990>
- Shulman, L.S. (1986). Those who understand: Knowledge Growth in Teaching. *Educational Researcher*, 15(2), 4-14. <https://doi.org/10.3102/0013189X015002004>
- Shulman, L.S. (1987). Knowledge and Teaching: Foundations of the New Reform. *Harvard Educational Review*, 57(1), 1-22. <http://dx.doi.org/10.17763/haer.57.1.j463w79r56455411>
- United Nations Educational, Scientific, and Cultural Organization. (2015). Not just hot air: Putting climate change education into practice. *United Nations Educational, Scientific, and Cultural Organization*.
- United Nations. (1992). United Nations framework convention on climate change. *United Nations*.
- Wise, S.B. (2010). Climate Change in the Classroom: Patterns, Motivations, and Barriers to Instruction among Colorado Science Teachers. *Journal of Geoscience Education*, 58(5), 297-309. <https://doi.org/10.5408/1.3559695>
- World Meteorological Organization. (2021). State of global climate 2021. *World Meteorological Organization*.
- World Meteorological Organization. (2024). State of the global climate 2023. *World Meteorological Organization*.

Author Contribution Statement

Mohammed Abdullah Al-Nofli: Conceptualization, Methodology, Writing - Original Draft, Formal Analysis, Funding Acquisition, Supervision. Osama Rajab Ibrahim: Investigating, Writing - Reviewing and Editing. Khalid Al Kalbani: Methodology, Writing-Reviewing and Editing. All the authors read and approved the final version of the manuscript.

Funding Information

This project is supported by the Ministry of Higher Education, Research, and Innovation in the Sultanate of Oman (SU/BFP/RG/01/2022).

Does this article screen for similarity?

Yes



Conflict of Interest

The authors have no conflicts of interest to declare. There is also no financial interest to report. The author certifies that the submission is original work and is not under review at any other publication.

About the License

© The Author(s) 2026. The text of this article is open access and licensed under a Creative Commons Attribution 4.0 International Licenses.

Cite this Article

Mohammed Abdullah Al-Nofli, Osama Ragab Ibrahim, Khalid Al Kalbani, Teachers' Perceptions of Climate Change Education in Oman, Asian Journal of Interdisciplinary Research, 9(2), (2026) 123-139. <https://doi.org/10.54392/ajir2627>

