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Investigation among students' and teachers' perception of climate health awareness regarding low carbon ecofriendly practices

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Introduction: Global climate change has become rapidly one of humanity's most pressing environmental concerns. To overcome this issue, public environmental awareness, sustainable behavior and understanding must be increased.

Method: So, this study explored the awareness of climate change, perception and attitude towards nature, impacts, effects, hopes, responsibility and engagement in low carbon behavior among students (n = 500) and faculty members (n = 50) from universities in Multan city. Data was collected using questionnaire from non-environmental science departments (n = 6). Descriptive statistics and Pearson correlation were used to compile the results.

Findings: Results concluded that awareness of climate change is higher in teachers than students. Both respondents showed similar responses regarding their perception of issues, and impacts but showed discrepancy while selecting effects of climate change. Participants' attitudes towards the environment and hope for mitigation are similar. Students and teachers believed that every sector has major responsibility except teachers agreed on full individual responsibility and international organization has a small portion of responsibility. Both participants showed no interest in engagement in low carbon activities.

Conclusion: It is imperative that colleges and universities invest in educational programs and sustainability initiatives in order to shape the attitudes and behaviors of students and faculty members towards environmental sustainability.

KEYWORDS

climate change, low carbon behavior, environmental awareness, policy development, global change

1 Introduction

Climate change is considered a threat and has become a global issue for humanity. Advanced countries, developing and underdeveloped regions face problems that arise from climatic shifting (Liu et al., 2018; Patz et al., 2007). To exist, all living being requires resources from the environment. It would be difficult for life to survive in a distressed environment if not protected (Jharotia, 2018). Problems like floods, storms, and droughts in addition, since the industrial revolution, greenhouse gases: Carbon dioxide (CO_2), Methane (CH), Nitrous

oxide (N_2O), Hydrofluorocarbons (HFC), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF_6) confronted as a result of human interference. Pakistan is one of the affected countries because of climate change and environmental degradation. In 2011, 40% carbon dioxide emission was recorded (Tian et al., 2016). The commitment was signed between the Kyoto Protocol and developed countries to reduce greenhouse gas emissions. But targets were not achieved by the combined effort of 37 countries during the 2008–2012 timeline (Aichele and Felbermayr, 2012; Grunewald and Martinez-Zarzoso, 2016; Guo et al., 2022). UNFCCC is working purposely to stabilize the number of gases, and the objective is to decrease the average global temperature 20 C–1.50 C (Rogelj et al., 2017). With this aim, UNFCCC signed an international agreement known as the 21st Conference of Parties (COP-21). In current years, Pakistan has taken the initiative to contribute to UNFCCC's aim as per guidelines, prepared the baseline of gases emission, and submitted it to UNFCCC in 2003. Various sectors generated GHG emissions in 2012. Carbon dioxide is dominating gas that increases 42% during the 1990 to 2010 duration followed by methane that has arisen up to 40% in the atmosphere (EDGAR European Commission, 2009; US EPA, 2016; Ul-Haq Z et al., 2017; Ullah et al., 2018; IPCC, 2008). The primary source of emission of these gases is transportation, energy usage, commercial and industrial sectors, agriculture, livestock, and waste. Currently, Pakistan is at 135th position due to the 0.8% of total GHGs emission. From 1970 to 2019, dominated facts of carbon dioxide emission recorded as 17.7 to 223.6 million tons and reported rise and fall from 15.38% to 1.33% accordingly and it will be anticipated to increase up to 1,603 Mt CO_2-eq by the end of 2030 (Nasir and Ur, 2011; Mercan and Karakaya, 2015; Ahmad et al., 2017; Mirza and Kanwal, 2017; Hussain et al., 2019). Many researchers bring the results into light that the amount of carbon dioxide released mostly from energy consumption, the manufacturing sector of industry contribute in CO_2 emission with rising of 169% (increase to 17.098 Tg to 46.122 Tg according to EDGAR data revelations, 2009). Agriculture caused 39% of emissions, 30% of improper use of land emitted gases, and deforestation (Ullah et al., 2018; Khan et al., 2011; Nazir and Ahmad, 2016; Tian et al., 2016; Xu et al., 2021).

Moreover, since 2008, Pakistan's waste disposal plants have emitted 4.733 Mt CO_2-eq of CH_4 as GHG emissions. In additions, constructional activities trigger negative impacts on the environment by dispose-off waste material without proper management. One study conducted survey in Pakistan to assess environmental risks associated with the construction waste products. Main determinants were organizational and government support, regulatory pressure, and economic and environmental performance. Hypothesis were tested by applying partial least square and compose reliability analysis. Results showed significance among environmental practices with organizational support, environmental and economic performances. However, results also showed negative significance between environmental practices with human resource quality, customer pressure and government support (Khan et al., 2021; Ali et al., 2022b). Therefore, these crises have triggered the thoughts of scientists, media, environmentalists, and educational practitioners. In 2009, UNESCO launched the climate change resourceful program in the 15th meeting of UNFCCC in Copenhagen, Denmark. This program concentrated on mitigation and adaptation features that are essential for sustainability. Due to limited financial and technical resources, Pakistan's government is responsible for implementing policies for environmental awareness in the energy sector, agriculture, and biodiversity departments. But due to a lack of coordination and awareness, the movement has stalled. Therefore, the UNESCO program performs a significant function in making people aware of solving issues and changing their living. Educating the people and making them aware of these issues is diverse. For this purpose, schools, colleges, and universities are helpful options to raise their voices about an environmental issue in the future. But it is necessary to analyse the student's knowledge at every level. Their knowledge needs to be published to create new methods and incorporate them into their curriculum accordingly.

2 Literature review

2.1 Climate change and vulnerability debate in Pakistan

It has been studied that climate change is associated with Greenhouse Gas emissions (Hanson et al., 2011). The most probable reason behind its occurrence is an imbalance in the activities of humans. Climate change is mainly contributing to socio-economic issues around the globe. The vulnerability in the regions of Afro-Asian is much higher than the other regions. Further, developing countries are considered more vulnerable to climate change than developed countries (Fahad and Wang, 2020; Zhu et al., 2022).

Moreover, the share of developing countries in GHG emissions are smaller compared to other developed countries (Khan, 2011; Corbera et al., 2010). Pakistan is considered a developing country that shares the same fate with various other Afro-Asian countries regarding the socio-economic influence in climate change. The natural resources and the economy of Pakistan are mainly dependent on agriculture. It largely contributes approximately 21% of GDP. Further, it mainly contributes only 1% to the total emission of Greenhouse gases. As per the global climate risk index, 2018, Pakistan is counted in those ten states which are mostly affected by the change in climate (Abid et al., 2016; Mir et al., 2017). The awareness of climate change points out the knowledge of the main concepts related to climate change.

Climate literacy refers to climate learning by introducing the climate curriculum in the education system. The awareness of climate change helps mobilize the masses to pay attention to all the issues. There are different causes of low climate awareness and education in Pakistan. The lack of political aspect has resulted in low climate awareness and education in Pakistan (Leal Filho et al., 2021). Then the education system helps to create public awareness, but it has ultimately failed to prove and adjust according to the emerging requirements. They have not added as the core issue in the curriculum of education. Further, the focus of education is mainly on the aspect of the job. Therefore, they only pay attention to facilitating the students' employment and pay less attention to creating climate awareness. Moreover, the leading organizations which play an essential role in creating awareness are civil and non-government. However, they are doing much to

create awareness (Leal Filho et al., 2021; Hu et al., 2023; Hu et al., 2023; Shang et al., 2023). Hence, these are some common reasons for Pakistan's low climate awareness and literacy.

2.2 Impact of climate change on global health

The change in climate influences human health with the help of various mechanisms, which are mostly associated and usually modulated by health determinants. Climate change directly impacts the health of humans and is evident in various diseases such as malaria and Cholera. At the global level, the health of humans is mainly threatened by enhanced air pollution, degradation in soil, and alterations in safety (Cordero et al., 2020). Climate change also influences health by impacting socio-economic, physical, and mental wellbeing. The analysis of climate change highlights that the rate of change of average temperature in the northern side is considered higher than in southern Pakistan. The increase in temperature results in the melting of glaciers, and hence it imposes a direct effect globally. Climate change is considered the greatest threat to the health of humans in the 21st century, and thus it has put a lot of lives at risk (Hayes et al., 2018).

It has been studied that air pollution can cause the death of millions of people around the globe, and thus it is the most significant factor that affects global health. Minimization in air quality is because of the emissions of greenhouse gases. Greenhouse gases are caused by transport, industry, buildings, and agriculture (Hanaki and Pereira, 2018). The generation of heat and electricity refers to be the most significant factor that results in the emission of greenhouse gases. Climate change is due to the various greenhouse gases, which have a global impact.

2.3 Role of institutes and media in creating awareness

The graduate school of media has a record of creating awareness among the students with the help of different programs such as "giving nature a voice" and "voices from the roof of the world." Further, another institute of Muslim civilization has several experts in medical anthropology, which helps to create an understanding of various issues (Bhutta et al., 2020). Moreover, the education institutes for the development can assist in giving training to the teachers who will ultimately educate the students in future about the climate change and global health. The agha khan university has different centers that can work with global health and development institutes to conduct the study to work on the issues and problems related to climate change (Sengupta et al., 2020).

Many universities have recognized their responsibility to prepare the students to contribute to reducing the effects of climate change (Sowers et al., 2011). The higher education providers have made the dual strategy in which the universities are targeting to become the institutions of "carbon neutral" with the adoption of various practices related to low carbon. Further, they are creating the curriculum and adopting the approaches to educate the students about carbon neutrality and climate change mitigation techniques. Hence, there is a strong need to harness the education power to combat and adapt to the difference in the climate. (Monroe et al., 2019; Guo et al., 2022b). Further, this is mandatory to make sure that young people have the problem-solving and collaboration skills required for taking action. In the United States, 80% of the parents and 77% in the United Kingdom support climate change teaching in schools. In the United States, 86% of the teachers were firmed about teaching climate change. Thus, incorporating this type of collaborative approach in the experiences of schools to initiate the implementation of a new green learning agenda focused on creating a sustainable planet (Kwauk and Winthrop, 2021).

2.4 Awareness of environmental knowledge and education in Pakistan

With the progression of the 20th century, many academics have worked and continued to focus on environmental challenges, particularly global warming and climate change, from multi-dimensional perspectives. Private associations, ecological offices, and instructive organizations are coordinated in gatherings of individuals fighting to safeguard nature. Studies on perception and awareness in many countries are done mainly at the school level (Robelia and Murphy, 2012). There is limited literature found at the university level.

Many studies worked on awareness, and their results reported that a mediocre level of knowledge and environmental attitude found nil among school students (Sah and Bellad, 2015; Worlu and Glory Amadi, 2016). They selected universities and school teachers for the sampling in their study. Other publications also confirmed low awareness, uncertain results, knowledge gaps, and unable to understand the complexity of environmental education among teachers (Akinnubi et al., 2012; Nicholls and Stevenson, 2016; Herman et al., 2015; Herman et al., 2015; Nicholls and Stevenson, 2016; National Science Foundation, 2017; Dominique-Esther et al., 2019; Seroussi, 2019).

2.5 Effects of green-marketing

Furthermore, one study reported low green marketing awareness among private Egyptian students. They were unable to differentiate between eco-friendly and non-eco-friendly products. Even they do not know the benefits of purchasing organic products. Furthermore, positive and significant results supported in various studies (Superales and Samin, 2014; Sohaib, 2016; Padmanabhan et al., 2017; Agboola and Emmanuel, 2016; El-Sakka, 2016). They conducted lectures, surveys, pre-tests, pro-test, and orientations programs to notice the results among teachers and students during their research work. However, a positive connection was found between awareness and environment-friendly products (El-Sakka, 2016; Tian et al., 2022). The population may affect the results. In comparison, a high level of literacy among teachers and students showed an increased awareness level also found.

2.6 Role of government in climatic changes and their impacts

The majority of students think that government has responsibility and climate change seriously affects human health.

364/370 students selected forest degradation as a cause of climate change. 337/370 students reported that it is difficult to cope with the climate change problem because of late actions (Kumar et al., 2019). As far as a sustainable environment is concerned, everyone has to play their role and come forward to combat the crisis together. According to the SDGs, the 13th target is acquiring and implementing successful climate actions with youth involvement.

2.7 Role of youth in climatic change and its impacts

To engage in the effort, perception needs to be measured and, according to the results, prepare them to cope with issues. According to Busch et al. (2019), youth is the building block of the future's sustainable environment. Because sustainability depends on their daily activities and lifestyle, such as walking instead of a car, preferring unhealthy food over organic meals, consumption of water and energy, and so on. So, either their low carbon behaviour brings healthy life to the environment or artificial lifestyle harms it. Indeed, the choice of adaptation of behaviour and attitude can stimulate disasters like flooding, erosions, pollution, or degradation.

Limited studies have been published with different methodological approaches for sustainable University (Thurston and Eckelman, 2011; Abolarin et al., 2013; Güereca et al., 2013; Larsen et al., 2013; Ozawa-Meida et al., 2013; Townsend and Barrett, 2013; Jamelske et al., 2013; Alvarez et al., 2014; Hesselbarth and Schaltegger, 2014; Li et al., 2015). One study was conducted at the Norwegian University of Technology and Science to analyse students' carbon footprint. Participants were selected from different departments. Results noted lower than 50% carbon footprint in social science and humanities compared to those from natural science or engineering (Larsen et al., 2013; Liu t al., 2023a; Liu X. et al., 2023). Most research is completed on the overall estimation of carbon footprint. Inadequate work is explored from the participant's behaviour perspective as awareness is a tactical way to communicate and engage with the audience and prepare them for any catastrophic environmental problem (Jharotia, 2018). One research reported the amount of heating and cooling consumption behaviour was 30% and 50%, respectively, and 20% adjusted the tool and saved energy at low cost (Langevin et al., 2013). Besides some technical methods, some research interviewed and conducted surveys to analyse the public's low carbon behaviour. One study surveyed eco-friendly habit patterns in a large enterprise company. Results noted that 28% of respondents were not switched off their computers when they left. Moreover, 90% of employees were aware of their energy waste and were eager to embrace energy-saving initiatives. (Zhang et al., 2021; Wang et al., 2022; Nisiforou et al., 2012).

In this technological era, online surveys effectively examine the awareness level (Baruah, 2012). This online survey technique was used, and the result revealed a positive association between environmental awareness and adaptation of eco-friendly activities (Lillemo, 2013). Furthermore, one case study examined in the university explored individual behaviour on overall energy utilization and release of carbon dioxide, and a low carbon management system suggested changes in attitude (Jiang et al., 2013).

3 Data and methods

This paper is comprised of primary data. Because, this study focused on responses from students and teacher's perspective, who were from a different educational background studying and teaching in the university and selection of participants were random. Figure 1 elucidated the visual concept of the research method used in the study. After sorting, coding and finalizing, data were analyzed through SPSS by percentages presented in the form of tables, and highlighted responses indicated the higher number of responses reported for particular question. Research questions were developed based on four dimensions and calculated.

- ➢ Are students and teachers have awareness of climate change?
- ➢ What is the perception of students and teachers towards environmental issues, impacts and effects of climate change?
- ➢ What is the attitude of the students and teachers towards nature, hope and responsibility?
- ➢ Are teachers and students fully engaged in low carbon behavior, activities and face any hurdles in adaptation?
- ➢ Is there any positive correlation between dependent variables and independent variables?

4 Results

4.1 Demographic results of students and teachers

Table 1 comprised descriptive statistics of demographic data about participated teachers (gender, age, department, education, designation & experience) and students (gender, age, department, and degree). 37% male students and 63% female students (18–25 years of age) have participated in this study and a total of 77% of participants with the frequency of 385 were about as shown in the above table. Furthermore, 27.2% of students belong to the management science department. 20% of students belong to medical science and 20% social science departments. Business and Engineering students participated about 11% and 14.4% respectively and computer science students supported as low as 6.8%. 67.4% students were enrolled as an undergraduate while 21% students were enrolled in graduates and postgraduate degrees (11.4%).

Furthermore, the sample consists of slightly more females (56%) than males (44%). 56% of them were 26–33 years of age and 8% of teachers were 18–25 years while other teachers were above 33 years (36%). Most participants were medical science department (30%). The rest of the respondents were from the following departments: management science (18%), business (22%), computer science (14%) and social science (10%). Engineering teachers (6%) were the least participants. The majority of participants have done postgraduates degrees (48%). The average teacher had over 7–9 years of experience (42%). 8% of respondents preferred not to answer their experience.

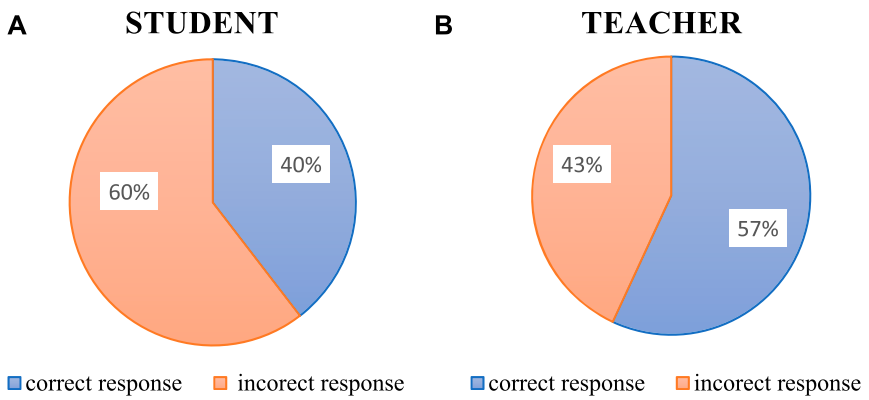

FIGURE 1
Climate change understanding [**(A)**: Students] [**(B)**: Teachers].

4.2 Awareness level of participants about basic understanding of climate change

In Figure 1, the pie chart has shown that 60% of students have not answered the questions correctly. Since various studies used different nature of survey but overall, the concept was the same. This finding is opposite to various results (Keskin, 2013; Ezeudu et al., 2016; Freije et al., 2017; Padmanabhan et al., 2017). But this result correlated with the study conducted by E. D. Oruonye, 2011. While most teachers (57%) reported correct answered. But this result is different from the other studies (Aladag, 2007; Akinnubi et al., 2012; Pradhan, 2002; Kahraman and Kazançoğlu, 2019; Miler et al., 2012; Worlu and Glory Amadi, 2016). Therefore, it is concluded that teachers were aware of the climatic issue.

4.3. Perception of participants on environmental issues, effects of climate change and impacts

4.3.1 Environmental issues and impacts

Students and teachers were asked to mark their views about the top three environmental issues and climate change impacts. Figures 2, 3 show views about issues and impacts. According to the respondents, overpopulation, climate change and traffic congestion are the top three issues as shown in Table 2. Interestingly, teachers think that ozone holes (0%) and radioactive waste (0%) are not the issues at all. On the contrary, students consider ozone holes (11.2%) and radioactive waste (6.2%) are also issues. With regards to select the top three impacts, both students and teachers consider that climate change is the responsible or rise of temperature (80%, 100%). Discrepancy showed while selecting the other two impacts. Students selected extreme weather events (54.80%) as the second major impact, lastly loss of biodiversity (35.40%). On the opposite, teachers think the suffering of the economy (80%) due to climate change and changes are threatening food production (54%).

4.3.2 Effects of climate change on sectors

In this research, students and teachers asked about the effects of climate change on various sectors. In Table 3 numbers indicated the scale range of effects (5-very serious, 4-serious, 3-neutral, 2 unserious, 1-non serious). Based on the responses, Table 3 displays and highlights the highest percentage. It is noticed ecological environment and wildlife have serious effects of climate change according to students and teachers (43%, 30%) respectively. Furthermore, both participants perceived moderate effects on industrial, commercial activities (32.4%, 42%) and infrastructure (41.2%, 46%) accordingly. Moreover, food supply (37.6%, 34%) is considered very serious by both contributors. However, both respondents have different views about energy use and supply, water supply and public health as faculty members think that climate change has very serious effects on public health (34%) but students considered health as moderate (41.4%). In addition, effects are very serious in the case of water supply in response to students (39.8%) but for teachers, it is moderate (32%). At last, for students, energy use and supply have serious effects (38.8%) as compared to teachers (34% moderate). This result is similar at the point of water supply and energy consumption in the study conducted by Al blooshi et al., 2020. This result is opposite from the study conducted by Bezon Kumar et al. (2019). Their results revealed public health as a very serious effect.

4.4 Participants' attitude towards environment, responsibility and hope on mitigation

4.4.1 Attitude towards environment

Students and teachers were asked to answer what they perceived about the attitude towards the environment. Table 4 highlighted the maximum value response based on the Likert scale (1-strongly disagree, 2- disagree, 3-neutral, 4-agree, 5- strongly agree). Both collaborators agree on the rights of plants and animals (39.4%, 44%), the earth can support (37.6%, 48.0%) and nature can tackle anthropogenic activities (32.6%, 44%). Furthermore, they strongly agree that people must obey nature's rules (59.2%, 58%) and

TABLE 1 Descriptive statistics of participant's demographics.

		Frequency	Percentage (%)
Students			
Gender	Male	184	37.0
	Female	316	63.0
Age	18–25 years	385	77.0
	26–33 years	62	12.4
	Prefer not to say	53	10.6
Department	Management Science	136	27.2
	Business Studies	55	11.0
	Social Science	103	20.6
	Computer Science	34	6.8
	Engineering	72	14.4
	Medical Science	100	20.0
Education	Under Graduate	337	67.4
	Graduate	105	21.0
	Post Graduate	57	11.4
	Prefer not to say	1	0.2
Teachers			
Gender	Male	22	44.0
	Female	28	56.0
Age	18–25 years	4	8.0
	26–33 years	28	56.0
	Above 33 years	18	36.0
Department	Management Science	9	18.0
	Business Studies	11	22.0
	Social Science	5	10.0
	Computer Science	7	14.0
	Engineering	3	6.0
	Medical Science	15	30.0
Education	Graduate	12	24.0
	Post Graduate	24	48.0
	Prefer not to say	14	28.0
Designation	Visiting	11	22.0
	Permanent	26	52.0
	On Contract	13	26.0
Experience	0–2 years	5	10.0
	3–6 years	13	26.0
	7–9 years	21	42.0
	Above 9 years	7	14.0
	Prefer not to say	4	8.0

disasters can interfere with nature (46.2%, 50%) respectively. Both group members showed disagreement on people can ruin the environment (28%, 38%) and they can rule over nature (29%, 38.4%) accordingly. Having said that students (31.4%) and teachers (36%) are neutral about people will know how to control nature. In contrast with a similar response, (44%, 56.8%) students agree on people are abusing the environment and lifestyle can change the environment, while teachers (42.6%, 56.8%) strongly agree.

4.4.2 Hope on mitigation

Along with the effects and impacts, it is impossible to ignore the problem solution. Table 5 shows the hope on mitigation with the Likert scale (1-strongly disagree, 2- disagree, 3-neutral, 4-agree, 5-agree). Results reveal the similarity of responses between students and teachers. Both are neutral on individual actions (37.8%, 46.0%) and influence change others views to adopt a green lifestyle (40.2%, 38.0%) can help in mitigation. They agreed that technology can be helpful; their actions and various sectors can take and improve climate change problems. More than this, they are neutral with significant changes through awareness. Above all, both participants strongly agree that their actions are too late to tackle serious problems.

4.4.3 Responsibility to combat climate-related issues

Each sector plays a responsible role in combating climate change. In Table 6, participants were asked to report on which sector is fully responsible-5, a major portion of responsibility-4, half of the responsible- 3, a small portion of responsibility-2 and no responsibility-1. It is noticed that students think that government (37.6%), industries/business sector (43.0%), the consumer (34.4%), environmental organization (38.6%), international organization (29.2%) and as an individual (27%) have major portion of responsibility. Although, teachers also reported that government (30%), industrial/business areas (50%), the consumer (34%) and environmental organizations (36%) have the major portion of the responsibility of reducing climate change problem, but according to their perception international organization (38%) are somewhat responsible and it also indicates that individual (29%) are fully responsible to cope with climate-related issues. One study conducted by Tse. (2013) reported a similarity that the industrial and business sector has most of the responsibility except government. Results of Bezon Kumar et al., the study found that individuals and consumers are not responsible however the government has almost all the responsibility (Kumar et al., 2019; Bai et al., 2023; Li et al., 2023).

4.5 Participants' engagement in low carbon behavior

4.5.1 Involvement and hurdles in adapting ecofriendly practices

Table 7, displays the responses of respondent involvement in low carbon behavior. Highlighted values elucidate the high percentage

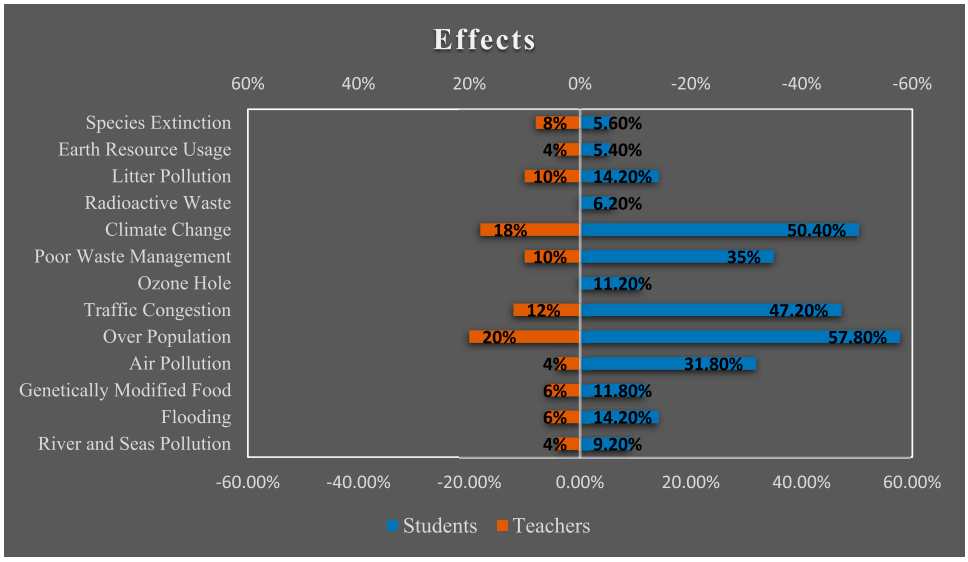

FIGURE 2
Environmental views responded by students and teachers.

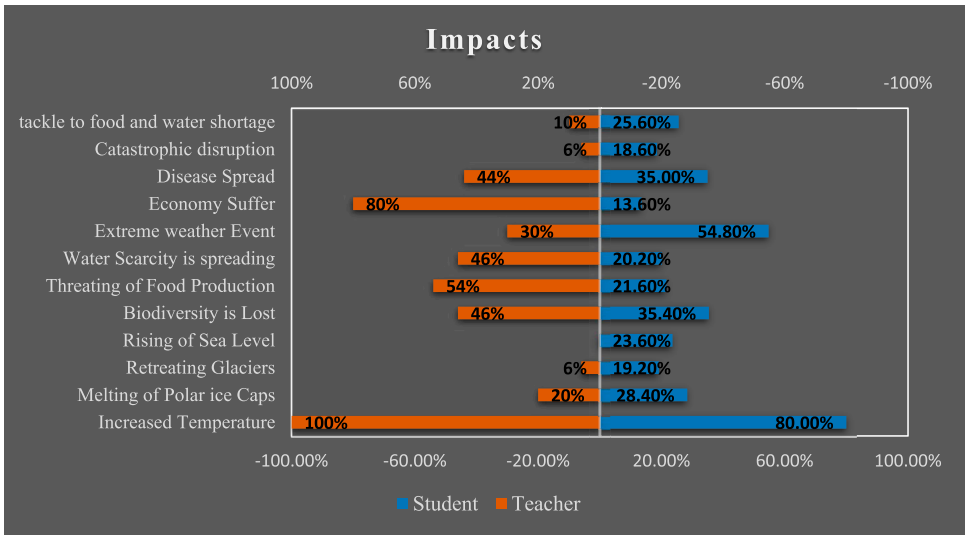

FIGURE 3
Impacts of climate change responded by students and teachers.

TABLE 2 The top three similar environmental issues considered by students and teachers.

Rank	Environmental issues
1	Over population
2	Climate change
3	Traffic congestion

from the scale of strongly agree to strongly disagree as 5, 4, 3, 2, 1. Both participants showed similar behavior as they buy fewer packaged products (25.80%, 32%), they prefer agreement towards vegetable meal (28.80%, 28%), students (33.60%) and teachers (28%) agree on avoiding food residue. And they strongly agree on the use of public transport (32.80%, 30%) accordingly. On the contrary, the difference was found among students and teachers. For example, students disagree on bring

TABLE 3 Overall top-rated response (highlighted) on the impacts of climate change on different sectors.

	Student					Teacher				
	5 (%)	4 (%)	3 (%)	2 (%)	1 (%)	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Ecological environment & wildlife	35.4	43.0	15.8	3.2	11.6	10.0	8.0	2.4	30.0	28.0
Industrial & commercial activities	21.0	23.8	32.4	17.8	5.0	6.0	16.0	42.0	18.0	18.0
Built environment & infrastructure	14.6	28.6	41.2	11.6	4.0	10.0	10.0	46.0	26.0	8.0
Energy use & supply	22.0	38.8	28.0	8.4	2.8	8.0	16.0	34.0	30.0	12.0
Food supply	37.6	35.8	20.4	4.4	1.8	4.0	8.0	28.0	26.0	34.0
Water supply	39.8	32.6	18.4	6.0	3.2	14.0	20.0	32.0	8.0	18.0
People's health	6.0	5.4	41.4	13.8	10.0	4.0	4.0	8.0	14.0	34.0

Where 5, very serious; 4, serious; 3, neutral; 2, unserious; 1, non serious.

TABLE 4 Overall top-rated response (highlighted) on attitude towards environment.

	1		2		3		4		5	
	S (%)	T (%)	S (%)	T (%)	S (%)	T (%)	S (%)	T (%)	S (%)	T (%)
Rights of plants and animals.	8.8	4.0	13.4	14.0	14.6	18.0	39.8	44.0	23.4	20.0
Earth can support many people.	6.8	4.0	23.4	12.0	14.2	12.0	37.6	48.0	18.0	24.0
People are clever enough to keep from ruining the earth's environment.	20.4	22	28.0	38	17.6	14	24.2	12	9.8	14
People must obey the laws of nature.	3.0	4	5.0	2	9.0	10	23.8	26	59.2	58
Disastrous results might occur by interfering with nature.	5.2	0	5.0	6.0	11.4	8.0	32.2	36.0	46.2	50.0
Nature can tackle effect of human interference	8.4	8.0	23.8	16.0	23.4	22.0	32.6	44.0	11.8	10.0
People are supposed to rule over the rest of nature.	16.4	10.0	29.0	38.4	20.2	14.0	23.4	30.0	10.6	8.0
People abuses the environment.	4.6	10.0	7.2	4.0	12.2	2.0	33.4	44.0	42.6	40.0
People will know how to control nature.	8.4	6.0	21.2	18.0	31.4	36.0	26.0	30.0	13.0	10.0
People's life style can change the Earth environment.	2.0	14.0	4.0	2.0	10.8	6.0	56.8	36.0	56.8	42.0

Where S, students; T, teachers; 1-strongly disagree, 2- disagree, 3-neutral, 4-agree, 5- strongly agree.

TABLE 5 Overall top-rated response (highlighted) for hope on mitigation of climate change.

	1		2		3		4		5	
	S (%)	t (%)	s (%)	t (%)	s (%)	t (%)	s (%)	t (%)	s (%)	t (%)
Climate change issues can be mitigated by individual actions	16.0	10.0	10.2	8.0	37.8	46.0	24.2	24.0	11.8	12.0
My Influence can change others view in order to adopt low-carbon lifestyle to combat climate change.	5.0	4.0	20.6	24.0	40.2	38.0	26.4	26.0	7.8	8.0
My actions can improve climate change problem.	5.8	2.0	11.8	4.0	31.4	36.0	37.0	42.0	14.0	16.0
Technology can be helpful in mitigating the climate change problem.	7.6	10.0	15.6	14.0	25.4	28.0	37.6	36.0	13.8	12.0
Various sectors in many countries take the issue of climate change seriously.	13.2	20.0	15.6	18.0	20.2	18.0	28.2	24.0	22.8	20.0
Awareness of climate change has increased significantly in society.	10.4	4.0	19.4	14.0	31.2	40.0	25.0	36.0	14.0	6.0
Problem of climate change is serious and our actions are already too late.	3.8	2.0	9.2	8.0	17.8	30.0	32.4	26.0	36.8	34.0

Where S, students; T, teachers; 1-strongly disagree, 2- disagree, 3-neutral, 4-agree, 5- strongly agree.

TABLE 6 Overall top-rated response (highlighted) on responsibility of various areas.

	Student					Teacher				
	5 (%)	4 (%)	3 (%)	2 (%)	1 (%)	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Government	14.8	37.6	19.2	12.8	15.6	14.0	12.0	26.0	30.0	18.0
Industry & business sector	17.2	43.0	21.2	15.8	2.8	2.0	14.0	20.0	50.0	14.0
Consumer	17.8	34.4	33.6	9.4	4.8	4.0	10.0	30.0	34.0	22.0
Environmental organization	19.0	38.6	19.6	19.4	3.8	2.0	20.0	24.0	36.0	18.0
International organization	19.0	29.2	21.6	24.2	5.6	6.0	38.0	16.0	30.0	10.0
Individual	26.0	27.0	19.6	19.2	8.2	4.0	20.0	24.0	23.0	29.0

5, Where fully responsible; 4, a major portion of responsibility; 3, half of the responsible; 2, a small portion of responsibility; 1, and no responsibility.

TABLE 7 Overall top-rated response (highlighted) on participation in low carbon behavior.

	Student					Teacher				
	5 (%)	4 (%)	3 (%)	2 (%)	1 (%)	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Participation in low carbon behavior										
Purchase less packaged products	11.0	18.0	25.0	19.8	25.8	32.0	14.0	26.0	20.0	8.0
Homemade shopping bag	14.2	23.6	18.2	23.8	20.0	29.0	23.0	16.0	26.0	6.0
Recycling	22.0	17.6	25.8	15.0	19.6	16.0	26.0	24.0	16.0	18.0
Plant based meals	16.2	28.8	22.6	20.0	12.4	10.0	20.0	26.0	28.0	16.0
Buy organic food	17.4	26.0	27.0	19.2	10.0	18.0	22.0	20.0	24.0	16.0
Avoid food waste	15.6	33.6	23.0	16.6	11.2	16.0	16.0	20.0	28.0	20.0
Use public transport	32.8	28.0	16.4	12.4	10.4	17.0	8.0	18.0	27.0	30.0
AC Thermostat to 26°C	26.8	26.6	24.0	11.6	11.0	10.0	6.0	36.0	24.0	24.0
Participate in ecofriendly behavior	25.6	22.8	19.2	16.0	16.4	8.0	20.0	32.0	14.0	26.0
Saving water	14.6	29.0	26.2	16.8	13.4	32.0	14.0	26.0	20.0	8.0
Barriers/hurdles faced in adapting low carbon behavior										
Lack of interest	12.0	33.4	14.6	18.8	21.2	30.0	10.0	16.0	38.0	6.0
No lifestyle change	14.4	36.4	16.6	24.8	7.6	8.0	38.0	12.0	36.0	6.0
Need of more time and expense for perform green lifestyle	19.8	43.6	17.4	13.2	6.0	4.0	20.0	20.0	34.0	22.0
Lack of opportunities (facilities/choices)	29.8	44.0	11.6	11.2	3.4	8.0	18.0	42.0	30.0	2.0
Lack of knowledge and skills	31.4	31.8	16.4	13.0	7.4	6.0	10.0	20.0	28.0	36.0

Where 1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree.

own shopping bag (23.80%) while teachers strongly disagree (29%). Students are neutral about recycling (25.80%) but 26% of teachers disagree. Students are strongly agreed on turning the AC thermostat to 26 C (26.80%) and participation (25%) however teachers are neutral about turning ac thermostat (36%) and involvement (32%). In the end, students agree (29%) on the water running while brushing teeth while teachers are strongly disagreed (32%).

Moreover, students and teachers were asked about barriers they face in adopting green living activities. Agreement noted by students and teachers in terms of lack of interest (33.4%, 38.0%) and lack of time and expense (43.6%, 34%) respectively. In addition, students are agreed that they face hurdles such as lack of opportunities (44.0%), lack of knowledge (31.8%) and no change in current lifestyle36.4%). However, teachers showed disagreement on no current lifestyle change (38.0%), furthermore, they are neutral about lack of opportunities (42.0%), but they strongly agree that lack of knowledge and skills (36.0%) is one of the major barriers.

4.5.2 Sustainable behavior on daily basis

Table 8, displays the students and teacher's activities done on daily basis. Sustainable behavior has many facets; Both participants buy energy savers just to save money (33.20%,

TABLE 8 Overall top-rated response (highlighted) on activities done on daily basis.

		Walk or cycle to work (%)	Use public transport (%)	Turn off lights when not using (%)	Buy energy savers (%)	Buy organic food (%)	Recycling things (%)	Purchase greenhouse friendly products (%)
Convenience	Student	20	22.80	6.80	11	8.60	38	10.40
	Teacher	26	18	12	6	12	10	6
To save money	Student	13.60	31.60	27.60	33.20	7.00	13.80	7.00
	Teacher	16	28	20	38	8	44	10
Protect environment	Student	16.00	18.80	17.60	23.60	11.60	41.40	45
	Teacher	6	16	20	22	6	44	60
For health	Student	44.40	4.40	4.20	9.80	49.60	15.40	8.40
	Teacher	34	30	6	12	56	4	8
Habit	Student	10	21.80	11.80	10.80	10.40	16.40	18.20
	Teacher	14	14	10	12	18	6	2
Moral obligation	Student	10.20	13.60	32	16.60	12.80	23.40	31
	Teacher	12	20	38	10	10	24	28

TABLE 9 Correlational analysis between dimensions and demographic variables of students.

Dimensions	Items	Gender	Age	Degree	Department
Awareness	Understanding of climate change	0.391	−0.258	0.393	0.408
Perception	Environmental issues	**0.990****	0.004	−0.136	−0.272**
	Impacts of climate change	0.009	−0.034	−0.035	−0.038
	Effect of climate change	0.019	−0.098	0.034	−0.081
Attitude	Towards environment	0.001	−0.093	0.097	0.028
	Hope on mitigating the problem	0.067	0.001	−0.029	−0.063
	Responsibility	**0.990****	−0.002	−0.140	−0.263**
Engagement	Engagement in LCB	0.030	−0.014	−0.018	−0.011
	Major hurdles in adapting LC activities	−0.013	−0.041	0.091	0.050
	Activities may do on regular basis	0.049	0.068	−0.033	0.011

Significance Levels: * = $p < 0.10$: ** = $p < 0.05$; *** = $p < 0.01$.
+***positive correlation, -**negative correlation.
Bold values mean just to highlight the positive significance.

38%), protect the environment by purchasing eco-friendly products (45%, 60%), they are conscious about health so they buy organic food (49.60%, 56%) and turning off light when not using (32%, 38%) is considered as their moral obligation. On the other hand, students recycling things (38%) for their convenience while teachers prefer to walk/cycle to work (26%). In the end, students have the habit of using public transport (21.80%) while teachers are habitual of buying organic food (18%). This study shows the opposite outcome in one study. A high proportion of residents responded that they were engaged in low-carbon behaviors from the perspective of transportation, such as "public transportation", "public bicycles or electro mobiles" and "walking" (Peng et al., 2018; Xu, et al., 2022; Khan et al., 2023).

4.6 Correlational analysis between demographics and questionnaires: Students

In Table 9, all dimensions were not correlated with the demographics but the only perception of environmental

TABLE 10 Correlational analysis between dimensions and demographic variables of teachers.

Dimensions	Teachers	Gender	Age	Degree	Department	Designation	Experience
Awareness	Understanding of climate change	**1.000****	**0.651****	**0.728****	**0.875****	**0.686****	**0.423****
Perception	Environmental issues	**0.521****	**0.998****	0.022	−0.025	**0.611****	0.001
	Impacts of climate change	−0.002	−0.045	0.026	0.037	−0.061	−0.189
	Effect of climate change	**0.364****	**0.381****	**0.380****	**0.439****	**0.429****	0.133
Attitude	Towards environment	**1.000****	0.146	**0.733****	**0.877****	**0.692****	**0.423****
	Hope on mitigating the problem	−0.063	**0.661****	0.091	−0.009	0.160	−0.191
	Responsibility	**0.263****	**0.586****	0.101	0.150	0.119	0.011
Engagement	Engagement in LCB	0.011	0.008	−0.057	0.025	−0.022	−0.096
	Major hurdles in adapting LC activities	−0.199	0.068	0.000	−0.078	0.040	−0.004
	Activities may do on regular basis	0.227	0.236	0.243	0.293	0.248	−0.065

Significance Levels: * = $p < 0.10$: ** = $p < 0.05$; *** = $p < 0.01$.
+**positive correlation, -**negative correlation.
Bold values mean just to highlight the positive significance.

issues, attitude towards responsibility and their source of information were positively significant with the gender. While the department has a negative association with the perception of issues, responsibility and selection of source, meaning that the department wise perception, attitude and news source indicated no interest. In essence, the result showed weak relationship strength between dependent variables (awareness, perception, attitude and engagement) and independent variables of demographics (gender, age, department and degree). Gender wise comparison with the dependent variable has not been significant thus, results aligned with the other studies. (Shobeiri et al., 2007; Bhawana, 2011; Dijkstra and Goedhart, 2012; Adejoke et al., 2014; Eroğlu et al., 2016; Gina et al., 2020).

4.7 Correlational analysis between demographics and questionnaires: Teachers

In Table 10, awareness level and source of information were found significantly correlated with all the demographic variables. Furthermore, teacher's perceptions on environmental issues were moderately positively correlated with gender, age and designation. In addition, their perception of the effects of climate change was also positively significant. Moreover, their attitudes towards hopes in positively correlated with age and responsibility were positively significant with gender and age. On the other hand, Perception towards impacts of climate change, engagement in low carbon behavior and trustworthiness of the source shows no correlations with demographic variables. While age has a negative association with the trustworthiness of the source. By assuming the positive correlation between all dimensions (awareness, perception, attitude and engagement) and independent variables of gender, age, degree, department, designation and experience, statistical analysis indicates an overall moderate relationship). However, one study contradicted with the attitude of teachers as respondents show positivity towards issues and education (Dal et al., 2015; Kumari, 2017).

5 Discussion

This paper investigated six dimensions: awareness, perception, attitude related to climate change and environment, engagement in low carbon behavior, selection and reliability of the source of information among university teachers and students of Multan city. Questionnaire surveys were distributed in five different universities. Within each university 6 different departments (medical science, business science, management science, computer science, social science, and engineering) were selected for this research. Six research questions were answered based on the results. Findings suggested that female (s = 63%, t = 56%) participated with more interest as compared to male participants (s = 37%, t = 44%). Younger students (77.0%) with an undergraduate degree (67.4%) have volunteered as compared to others. A senior teacher with permanent designation (52%), holding a post-graduate degree (48%), having more than 7 years of experience (42%), responded better as compared to the group having less than 25 years of age and above 33 years of age. Moreover, outcomes also reported that teachers are more knowledgeable than students. In this study, 30% of students answered incorrectly while teachers 29% answered correctly. Therefore, it is concluded that although teachers know about climate change, they were unable to convey the information properly among students. Therefore, it is summed up that teaching methodology related to the understanding of

climate change should be improved. More awareness would encourage them to participate in nature saving activities. Low awareness level about climate change coincided with the findings noticed in other studies (Bhawana, 2011; Chalise et al., 2015; Awan and Abbasi, 2017; Dalelo and Ababa, 2017; Ochieng and Koske, 2017; Pitpitunge, 2017; Sulistyawati et al., 2018). In terms, of perception analysis, both teachers and students showed similar concerns such as overpopulation, climate change and traffic congestion. Both respondents considered that climate change has impacts on increased temperature (s = 80%, t = 100%). However, the other two responses were contradicted each other. In one study, perception shows similar results regarding the rise of temperature (Kabir et al., 2016). But contradict another study as respondents recorded sea-level rise as an impact of climate change (Sulistyawati et al., 2018). Majority of students perceived that ecology/wildlife, energy sector, food and water supply are in serious conditions, while the majority of teachers reported moderate effects on water, energy supply, infrastructure and industrial/commercial activities. Participants attitude towards the environment are the same as they strongly agree on people's interference also abusing the environment and nature can handle the destruction. They must obey the laws of nature. Respondents were asked about the responsibility and students mentioned that everyone has the responsibility to cope with changes. But teachers agreed that government and individual citizen has the major portion of responsibility. Participants' hope on mitigation showed agreement toward personal actions, technology and sectors involvement. As well as they fully agreed on the seriousness of the problem and their late actions. Faculty members and students are somehow involved in various behavioral activities, for example, use public transport adjust the thermostat to 26 C, reduce water, buy ecofriendly and organic products just to remain healthy, save money while protecting the environment. Furthermore, teachers agreed on facing hurdles such as lack of interest, change, opportunities, knowledge, and finances. But students agreed on lack of interest, expanses, and knowledge but disagreed on change in lifestyle. In the end, this study answered the question about the positive correlational analysis between questionnaire variables with demographic items. Collectively, gender demographic factor is strongly and positively correlated with the perception of environmental issues and student's attitude towards responsibility. But other demographic factors were not associated with the awareness, perception, attitude and involvement. It is also noted that awareness levels of climate change among teachers are positively correlated in terms of all demographic factors. Moreover, different ages, degrees, departments and designation levels among male and female faculty members are also positively associated with the overall perception. Surprisingly, students and teachers were not motivated in engaging in green living activities, also no positive correlation was found. A positive correlation was noticed in terms of low carbon intentions and behavior but participants were residents of China (Ojala, 2012; Yang et al., 2020; Al Blooshi et al., 2020; Ali et al., 2022a). This result has contradicted with the findings that reported a significant relationship between socio-demographic variables and dimensions towards climate issues but with the individual as a participant (Masud et al., 2017). In regards to degree and awareness, no or weak correlation was found and supported the study within the literature (Newton and Meyer, 2013; Rajapaksa et al., 2018). But strongest correlation with awareness and resulted in significant association with awareness noted in previous studies (Guo and Sun, 2017; Branchini et al., 2015; Topal et al., 2021; Topal et al., 2021). In their study, samples were the public.

6 Conclusion

This disorganized assessment might be the lengthy questionnaire, also face difficulties in interpreting the questions and de-motivated in reading lengthy questions. Low carbon mitigation present environmental change will lead to sustainability, which is a prime target in the current technology-based era for the future generation. Furthermore, this study showed that teachers were aware of climatic issues, but they were unable to convey them. This survey-based study gives the current status of student and teachers awareness and involvement in low carbon behavior provide predictions for improvement. Because this study has a limited budget and time frame, the sample size will be minimal. As a result, the authors of this research advocate for a more in-depth investigation to uncover the truth about this issue. In a nutshell, environmental-related content must not be limited to the curriculum it should be incorporated in extracurricular activities. More awareness research should be considered in Pakistan with diverse sampling. Literacy study should not focus on students and teachers, it must investigate among illiterate people in their local languages. Furthermore, other information sources must be strengthened and accessible to everyone. It should not be restricted to limited groups of communities. Lastly, the need for the development of a national climate change awareness policy that focuses on teachers as critical educational stakeholders is also recommended.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

MN wrote the manuscript and performed all the statistical analysis. AK and WU developed the theory and reviewed the manuscript. AW verified the analytical methods. MM and MN interpreted the results. All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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