Article

Environmental Awareness and Air Quality: The Mediating Role of Environmental Protective Behaviors

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Abstract: The purpose of this study is twofold: First, it tests the role of students' environmental awareness and climate change awareness in their environmental protective behavior and environment quality (EQ). Second, it tests the mediating role of environmental protective behaviors in the association between environment behavior, climate change behavior, and environment quality. Moreover, this study utilizes climate-friendly behaviors and pro-environmental behaviors to reflect environmental protective behaviors. The stratified random sampling technique was applied to collect data through a questionnaire from a sample of 403 graduate students enrolled in Higher Education Commission-recognized private and public universities of Pakistan. This study applied partial least squares structural equation modeling (PLS-SEM) to empirically estimate the results. This study found that climate change awareness significantly and positively affects climate-friendly behavior, environmental quality, and pro-environmental behavior. Similarly, environmental awareness significantly and positively affects environmental quality and pro-environmental behavior. Moreover, pro-environmental behavior significantly affects environmental quality. Indirect results indicate that pro-environmental behavior significantly mediates between climate change awareness and environmental quality, and between environmental awareness and environmental quality. The findings of this study suggest the importance of enhancing awareness of climate- and climate change-related issues among students to save the environment. Higher education institutions should design subjects and courses that will raise environmental and climate change awareness, and expose students to climate- and environment-friendly education.

Keywords: environmental awareness; climate change awareness; environmental knowledge; environment quality

1. Introduction

Rising environmental problems have remained a hot topic and an area of combative research for decades. Researchers are continuously trying to figure out the reasons behind environmental degradation. In this regard, many studies found that an increased level of carbon emissions is the main reason behind the increased environmental deterioration [1–3]. Practically, however, environmental deterioration is not inevitably bound to the high level of carbon emissions. A huge part of the deterioration in environmental quality is due to human activities. These activities are intentionally or unintentionally responsible for the deterioration in environmental quality [4].

Human activities are considered a fundamental factor behind environmental deterioration [5]. History shows that humans always exploit resources from the natural environment to fulfill their desire to improve their living standards, which gradually deteriorates environmental quality. Moreover, humans are also doing a lot of damage to the environment in their routine activities i.e.; by throwing garbage on streets, leaving the tap open, throwing

food, wrappers, and bottles on roads, burning plastic, etc. These human activities not only deteriorate environmental quality, but also impose adverse effects on the quality of life. For instance, due to bad environmental quality, people have to face serious health issues such as asthma, flu, coughing, malaria, or dengue, and many other diseases [6] that make individuals feel grief, anxiety, loss, and depression, which ultimately worsen the mental and physical wellbeing of individuals [7].

During the last century, due to advancements in science and technology, the world has experienced rapid growth in production and consumption that has brought a considerable improvement in life expectancy and life satisfaction. At the same time, this global growth leaves unprecedented impacts on environmental quality. Human production and consumption activities are dominating the planet, causing the continuous emission of CO2 and leaving catastrophic impressions on humanity and other species of the planet [8]. Therefore, it is necessary to educate human beings about the environmental consequences of their human actions. Numerous studies have been conducted to explain that a lack of environmental awareness is a great hurdle to developing environmentally friendly behavior among human beings [9]. Similarly, Burgess et al. [10] established that environmental knowledge plays a vital role in increasing environmental awareness and helps to shape pro-environmental behavior. Therefore, empirical research advocates that the spread of education about environmental issues makes people more conscious about the environment and inculcates in them pro-environmental behavior [10]. Although nongovernment and government agencies spread knowledge about the environment through media and printed material, it has been realized that human behavior is more complex and leads to great inconsistencies in results [9].

Therefore, raising awareness about climate and climate change issues among individuals is one of the possible solutions to dealing with environmental problems that are caused by human activities; with this awareness, individuals become conscious about these detrimental environmental effects and engage themselves in environmental protective/eco-friendly behaviors [11]. However, there are some misunderstandings regarding the consideration of the environmental awareness and climate change awareness concepts as equivalent, but they are different. Climate awareness refers to the capability of individuals to recognize the nature of the overall environmental process and problems, their concerns about environmental quality, and the magnitude by which they are devoted to environmental protective behaviors in their routine life [12], whereas climate change awareness refers to the capability of individuals to recognize the nature of climate change issues, i.e.; awareness about rising temperatures, high sea levels, extreme weather, and global warming [13]. Nonetheless, both types of awareness are significant predictors for environmental protective behaviors.

Environmental protective behavior is normally categorized into two sub-dimensions, i.e.; climate-friendly behaviors and pro-environmental behaviors. Climate-friendly behavior refers to behaviors which minimize the adverse pressure on ecological conditions with diversified degrees of regularity, while pro-environmental behaviors refer to behaviors in which individuals take "protective actions" towards the environment [14], which, in turn, will promote EQ. However, considering the importance of climate and climate change awareness (CCA), studies have recognized that it is crucial to test how to promote environmental quality. To answer this question, some researchers have entered the field. They indicated that educational institutions, i.e.; colleges or universities, play a critical role in promoting environmental awareness (EA), knowledge, and education among their students to promote their eco-friendly behaviors [15,16], which, in turn, limit environmental problems.

Presently, developing nations are anxious about integrating SDGs into their system. As environmental quality and SDGs are inseparable, it is arguable that the accomplishment of 5/16 sustainable development goals (SDGs), "e.g.; SDG6 (clean water and sanitation), SDG7 (affordable and clean water), SDG13 (climate action), SDG14 (life on land), and SDG15 (life below water)," are linked with improved environmental quality. As a result, there is a need to raise environmental quality through different direct and indirect activities.

Some studies advocate that direct activities, such as planting, that reduce CO_2 emissions help to improve environmental quality, while some studies advocate that indirect activities such as seminars, walks, and environmental education help to create awareness about environmental and ecological issues [17]. On the basis of above discussion, this study highlighted the existing gap in literature in Section 1.1 and describes that how the present study will bridge this gap.

1.1. Empirical Gap/Contributions of the Study

First, the present study figured out that the literature used found that climate change awareness among individuals helps to reduce different environmental problems [18]. Moreover, researchers utilized environment awareness and climate change awareness interchangeably, and did not make a clear distinction among both. However, this study contributes to the literature by utilizing environmental awareness and climate change awareness distinctly.

Second, the study found that environmental awareness and climate change awareness are significant predictors of environmental protective behaviors, categorized into climate-friendly behavior and pro-environmental behavior [14]. However, the focus of most of the researchers is only on one dimension of environmental protective behavior, pro-environmental behavior [19,20], while the other dimension of pro-environmental behavior is ignored.

Third, the present study observes that most past studies have focused on the nexus between environmental awareness and pro-environmental behavior [18]; however, studies on the relationship between environmental awareness and climate-friendly behavior are rarely reported in the literature. In addition to this, a relationship between climate change awareness and pro-environmental behavior, climate change behavior, and climate-friendly behavior has also been overlooked by prior researchers.

Fourth, the study found that researchers emphasized promoting environmental awareness among individuals to improve environmental quality [18]. However, to the best of our knowledge, the direct impact of ecological awareness (climate change and environmental awareness) on environmental quality has hardly been tested empirically, and is limited to a theoretical perspective only.

Fifth, the literature highlighted the significant mediating role of both dimensions of pro-environmental behaviors on the theoretical association between environmental awareness, climate change awareness, and environmental quality, but the empirical relationship is under research.

Finally, the present study believes that educational institutions, i.e., colleges or universities, play an essential role in creating awareness among their students about different ecological issues, which resultantly provokes the students to show eco-protective behaviors that is beneficial for environmental quality. However, to the best of our knowledge, only a few researchers have examined the role of environmental awareness and climate change awareness among university students [16].

Thus, the present study is designed to investigate, firstly, the role of students' environmental awareness and climate change awareness on their environmental protective behavior and environment quality. Secondly, the study tests the mediating role of environmental protective behaviors on the association between environmental awareness, climate change awareness, and environmental quality under the theoretical lenses of value belief norms, environmentally responsible behaviors, and theories of planned behavior.

2. Literature Review

As human beings have no other planet except earth to live on, human beings therefore started to think about how they can protect the earth and make it more plausible to live on. Now, it is a well-established phenomenon that the biological, physical, and chemical capabilities of the earth are decreasing over time. The deterioration of earth's capabilities is irreversible and is the result of anthropocentric activities. Anthropocentric philosophy

argued that human beings are the dominant species on the earth, human life is more precious compared to other species on earth, and all other species are considered resources at the disposal of human beings.

Anthropocentric philosophers believed that the earth is endowed with limited resources and a limited carrying capacity; human beings have the responsibility to safeguard these limited resources and utilize their energies to save them. Moreover, according to anthropocentric philosophy, human beings have moral obligations to protect the environment and limit its exploitation. By saving the environment, human beings are satisfying this ethical obligation toward other human beings; for instance, environmental pollution can be seen as immoral because it adversely affects human beings and creates health issues for those who are sickened by the air pollution created by a factory. Similarly, the misuse of natural resources is also considered immoral because it creates a great hurdle in the way of sustainable growth, depriving future generations of resources that the current generation is enjoying. In the 1970s, theologian and philosopher Rolston III [21] advocated that the protection of biodiversity is a moral duty of human beings, because failure to save the environment reflects disrespect of God's creation. Therefore, environmental education creates awareness among individuals that helps them to fulfill their moral obligation.

2.1. Climate Awareness and Environment Quality

Environment awareness refers to an individual's understanding of the natural environment and their actions to save or harm the natural environment. Environmental awareness is an essential part of our learning because it helps individuals become more committed to saving the planet and making it healthy and livable for future generations. Environmental awareness ensures the health and security of human beings and all other species on this planet. Human beings are more responsible for environmental degradation, so by making minor changes in their living style, they can save the planet and make it possible for future generations to enjoy enough resources, as are available to the present generation. Similarly, awareness of environmental change means an individual can understand the long-run changes in average weather patterns. Climate change awareness is necessary to achieve the sustainable development goals of climate action and life on the planet.

Most of the literature identified industrialization [22], urbanization [23], some foreign direct investment [24,25], and economic growth [26,27] as being responsible for environmental deteriorations, while some researchers identified that individual human activities are also responsible for environmental deterioration. For instance, Zhang et al. [5] and Appannagari [28] argued that individuals' activities, such as extraction of natural resources to fulfill their basic needs, i.e.; food, shelter, and water, use of atomizer sprays, throwing garbage into streets, leaving open the tap while brushing or washing clothes, throwing disposable sponges into the toilet, and using private transport for entertainment purposes, are all responsible for deteriorating the quality of the environment. However, a few studies established that climate education creates an awareness among youth that ultimately affects environmental quality. For example, Yeşilyur et al. [29] conducted a study on primary school students in the Gungoren district of Istanbul in the 2018–2019 academic year, and concluded that the students who received environmental education are more conscious about the environment and are more willing to participate in climate-saving activities.

Similarly, Omoogun et al. [30] theoretically established that environmental education creates awareness about the environment and climate change, but climate awareness brings no respect for the environment until our attitudes toward environmental quality shape up.

Demaidi and Al-Sahili [19] examined student behavior toward climate change and found that male students have a significantly higher level of awareness of climate change as compared to female students. Moreover, the study established that a female student who is a member of student societies and is studying engineering possesses a high level of climatic awareness as compared to a female who is not a member of student societies and is studying other subjects. On the contrary, Ribeiro et al. [31] stated that there is no difference between males and females regarding environmental awareness. Moreover,

the study established that environment awareness significantly affects the green attitude among male and female students in Portuguese higher education students.

Oliver et al. [32] tested the influence of environmental awareness among small-frame farming practice laborers. The study indicated that the laborers who were aware of different environmental issues are more likely to engage in eco-friendly behaviors that are very beneficial for environmental quality. Similarity Novotný et al. [33] believed that the environment is hampered by human activities. Their study investigated whether humans who are aware of the adverse effects of environmental issues are more likely to engage in eco-friendly initiatives that resultantly improve environmental quality.

Summing up the above discussion, the present study figured out that environmental awareness and climate change awareness are crucial to promoting eco-friendly behavior among individuals. The literature revealed that most studies examined the importance of environmental knowledge and levels of environmental awareness among individuals. This study aims to fill the gap in the literature by investigating the impact of environmental awareness on environmental quality. Moreover, it has been examined that researchers considered environmental awareness similar to climate change awareness, while both concepts are different by definition. For instance, environmental awareness refers to the awareness about the natural environment, i.e.; land, water, or similar natural resources, while climate change awareness refers to the awareness about climate issues, i.e.; greenhouse gas (GHG) emissions or similar sources of environmental pollution. The present study intends to fill the gap and aims to examine the impact of both climate change awareness and environmental awareness on environmental quality.

2.2. Environmental Awareness, Environmental Protective Behaviors and Environmental Quality

Environmental protective behavior is complex in its types, variety, and its casual linkages, so we need to understand the drivers and consequences of environmental protective behavior. Behavioral and social sciences state that internal psychological factors such as personal norms and values, environmental concerns, knowledge, and attitude determine environmentally friendly behaviors among individuals [34,35], while psychologists argue that environmental deterioration affects the mental and social health of the individual, so it is necessary to utilize psychological knowledge and tools to cultivate environmental protective behavior in individuals [36,37]. Moreover, economists advocate that external factors such as climate change knowledge and trust in sources of information about environmental issues are more important in promoting climate-friendly behaviors [38]. Therefore, this study advocates that awareness of the climate and climate change affect environmentally friendly behaviors; as such, a few studies conducted to highlight awareness as a predictor of environmentally friendly behavior are reviewed in the following section. Suárez-Varela et al. [39] conducted a study on a unique sample of 1436 households in the Spanish city of Granada, intending to analyze the role of environmental awareness on pro-environmental behaviors, and concluded that individual awareness about the environment does not need to be translated into personal actions to preserve the environment, while Fu et al. [15] indicated that environmental awareness is a significant predictor of pro-environmental behaviors. Hansmann et al. [40] examined the determinants of environmental protective behavior while examining the university students and technical and administrative staff of a university. After analyzing the data of 1864 respondents, the study showed a positive connection between environmental awareness and environmental protective behavior. The study concluded that the higher the level of environmental awareness, the more the individual will be concerned about environmental disputes and hence will engage in eco-friendly behaviors. Carducci et al. [41] also argued that an increased level of environmental awareness makes the individual engage in different climate-friendly and pro-environmental behaviors. Yuriev et al. [42] are concerned about the detrimental effects of environmental pollution instigated by human activities. The study argued that environmental pollution can be controlled by spreading awareness about different environmental and climate change issues among individuals. This awareness, in turn, provokes the

individuals to behave in an eco-friendly way which, resultantly, improves environmental quality. Aliman [43] indicated that environmental awareness motivates people to behave in an eco-protective way.

The above discussion indicated that the existing literature established a link between environmental awareness and environmental protective behavior. However, most of the previous studies utilized pro-environmental behavior to measure environmental protective behavior, while this study utilized climate-friendly behavior and pro-environmental behavior to measure environmental protective behavior.

As Kaida and Kaida [14] stated that environmental protective behavior is categorized into two distinct dimensions, i.e.; climate-friendly behavior and pro-environmental behavior, climate friendly behavior refers to such behaviors that minimize the adverse pressures on ecological conditions with diversified degrees of regularity. Such behaviors include routine environmental cleaning, i.e.; throwing garbage into dustbins instead of throwing it on the street, preferring the use of paper bags over a plastic bag, and so on, which helps to improve the health and wellbeing of individuals, while pro-environmental behavior refers to such behaviors in which individuals take protective actions towards the environment, i.e.; purchasing energy-efficient products, installing thermal insulation for an entire house, using GHG-free cars, and so on. The present study, therefore, attempts to contribute to the existing debate by analyzing the roles of climate-friendly behavior and pro-environmental behavior, as two distinct dimensions of environmental protective behavior, in environmental quality.
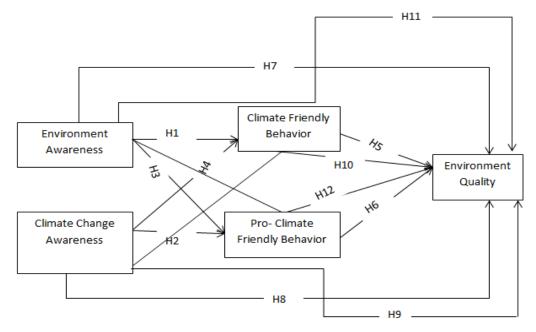
Moreover, several studies found that environmental quality is improved by engaging the people in environmental protective behaviors [19,20,44]. They argued that environmental protective behavior encourages individuals to engage in such behaviors which positively contribute to environmental quality. Eigner [45] also demonstrated the positive affiliation between environmental protective behavior and environmental quality. Suárez-Varela et al. [39] tested the influence of environmental protective behavior on environmental quality and the subjective wellbeing of individuals. The results of the study exhibited a positive affiliation among the selected variables.

Moreover, the above-discussed literature indicated that environmental protective behavior is highly influenced by environmental awareness and climate change awareness [18,32], which, in turn, positively contributes to environmental quality [19,33]. Hence, the present study expects a significant mediating role for environmental protective behavior on the association among environmental awareness, climate change awareness, and environmental quality. Hence, after considering the above literature, the present study proposes the following hypothesis that will extend the existing literature.

2.3. Theoretical Contribution

The conceptual model of the present study is presented in Figure 1. The theoretical and psychological linkage among the proposed study variables is justified under the theoretical lenses of the value belief norm (VBN) theory of pro-environmental behavior. Stern et al. [46] developed the VBN theory to explain the mechanism behind human beliefs, norms, and behaviors in the environmental context. This theory stated that environmental beliefs and personal norms have a link with pro-environmental behavior.

This study extends the VBN theory by utilizing it to assess the drivers of environmental degradation. Given the fact that values, beliefs, and norms teach individuals who they are and how they should engage in different activities, values therefore create awareness related to the environment among individuals, which in turn promotes feelings of responsibility among individuals that shape their pro-environmentally friendly behaviors. This statement is sufficient to prove the theoretical linkage between the awareness and behavior of individuals. Several researchers have used this theory in the field of the environment [47,48]. For instance, Zhang et al. [49] utilize VBN theory to explain that individual values and norms increase awareness about the climate and environmental responsibilities among individuals, and also increase their pro-climate behavioral intentions. Keeping in view

the above-mentioned studies, this study attempts to establish a link between awareness, environmentally friendly behavior, and environment quality.

Figure 1. Conceptual Framework.

This study aims to establish that individuals tend to behave in an eco-friendly manner when they have more awareness of the climate and climate change. Putting it differently, people behave in an eco-friendly manner after being aware of the environment and climate change [50]. This theory extends the VBN by establishing that awareness about consequences is the crucial determinant behind the individual's intention to perform environmental protective behaviors [42].

However, another theory, which is used as an underpinning to explain the psychological or theoretical linkage among the modeled variables, is the "theory of planned behavior" (TPB), proposed by Ajzen [51] in 1980. This theory explains how the intention of an individual shapes particular behaviors. TPB aimed to explain that human behaviors are determined by the beliefs, expectations, and conceptions regarding the consequences of a specific behavior. Moreover, TPB includes individual attitude, available information, and subjective norms to explain individual actions, but the author of the theory also accepts the importance of other variables in explaining individual behaviors.

By taking the theory's finding that other variables are also important as a foundation, many studies were conducted to explain the role of socio-demographic factors [52], environmental knowledge [53], and self-efficacy [54] in individual attitudes, intentions, and behaviors. Similarly, Yuriev et al. [42] conducted a meta-analysis and found that 72% of studies utilized an extended version of TPB that incorporated other factors that can improve the predictive power of the model. Moreover, some studies also established that context is also important to define the attitude and behaviors of individuals [55].

Therefore, this study contributes to the theoretical literature by introducing awareness of the environment and climate change to explain environmental protective behaviors, and this study also establishes a link between individual environmental protective behaviors and environmental quality. Moreover, this study also utilized the Pakistan context to explain the relationship among the variables, which also extends the existing literature.

Finally, this study also utilized the theory of environmentally responsible behavior (ERB) to explain how the intention to act influences ERB. The ERB theory was proposed by Hines et al. [56], who argued that a sense of responsibility and awareness determine whether a person will adopt some behavior or not. This study also extends ERB theory by explaining that awareness develops the individual intentions that ultimately influence ERB.

2.4. Conceptual Framework

Based on the theories and observed gap in the literature review, this study develops a conceptual framework that helps to understand that environmental protective behaviors are important to improve environmental quality. Moreover, this study also explains the key drivers of environmental protective behaviors and environmental degradation. Keeping in view the literature gap, this study first utilized environmental awareness and climate change awareness separately as predictors of environmental protective behavior. Second, this study utilized environmentally friendly behavior and pro-environmental behavior separately to increase the reader's understanding and to enrich the existing empirical literature. Most importantly, this study extends the empirical literature by investigating the mediation role of environmentally friendly behavior and pro-environmental behavior in awareness of the climate, awareness of climate change, and environmental quality. Conclusively, based on the above theories and the observed gap in the literature review section, this study develops a conceptual framework that is presented in Figure 1.

2.5. Hypothesis

Based on the above conceptual framework, this study proposed the following hypotheses:

Hypothesis 1 (H1): *There is a positive relationship between environmental awareness and environmental quality.*

Hypothesis 2 (H2): *There is a positive relationship between climate change awareness and environmental quality.*

Hypothesis 3 (H3): *There is a positive relationship between environmental awareness and climate-friendly behaviors.*

Hypothesis 4 (H4): *There is a positive relationship between environmental awareness and pro-environmental behaviors.*

Hypothesis 5 (H5): *There is a positive relationship between climate change awareness and climate-friendly behaviors.*

Hypothesis 6 (H6): *There is a positive relationship between climate change awareness and pro-environmental behaviors.*

Hypothesis 7 (H7): *There is a positive relationship between climate-friendly behavior and environmental quality.*

Hypothesis 8 (H8): *There is a positive relationship between pro-environmental behavior and environmental quality.*

Hypothesis 9 (H9): *Pro-environmental behavior mediates the relationship between environmental awareness and environmental quality.*

Hypothesis 10 (H10): *Climate-friendly behavior mediates the relationship between climate change awareness and environmental quality.*

Hypothesis 11 (H11): *Pro-environmental behavior mediates the relationship between climate change awareness and environmental quality.*

Hypothesis 12 (H12): *Climate-friendly behavior mediates the relationship between environmental awareness and environmental quality.*

3. Methodology

3.1. Research Design

A research design is a framework of research methods and techniques that a researcher adopts to find the solution to the research problem. The nature of the research problem helps the researcher to adopt appropriate research methods. The nature of this study is quantitative and explanatory; for instance, the study first aims to explain the impact of awareness of the environment and climate change on environmental protective behavior. Second, it explains the impact of environmental protective behavior on environmental quality, and third, it explains the mediating role of environmental protective behavior in awareness of the environment and climate change and environmental quality. Keeping in view the quantitative nature of the research problem, this study established the hypotheses and framework, and utilizes a questionnaire to collect data for the analysis of the proposed hypotheses and to test and validate the conceptual framework related to environmental quality.

The current study collected data through questionnaires from students of public and private higher educational institutions of Lahore (capital of Punjab, Pakistan). This study distributed 450 printed questionnaires among the students in person, and 405 questionnaires were returned. The data are cross-sectional. They were collected in 6 months from January 2021 to June 2021. These students were studying in different disciplines, i.e., natural, environmental, and social sciences. The data were collected from students of different semesters, with the condition that respondents must have completed one year of their study and have studied one compulsory course related to the environment. The conditions of one year of completed study and the study of at least one subject related to the environment ensures a clear understanding in the respondents of environmental quality, climate change, and climate-friendly behavior.

3.2. Sample, Sample Size, and Sampling Technique

A stratified random sampling technique was used to draw the sample from the known population. In Punjab, out of 38 universities, 21 universities are in the public sector and 17 universities are in the private sector. However, 25 universities are located in Lahore, while 13 universities are located in cities in Punjab other than Lahore. This study distributed the questionnaire that is presented in Appendix A among the students studying in different disciplines, i.e.; natural, environmental, and social sciences, in 25 universities of Lahore, 11 of which are in the public sector and 14 in the private sector. This study divides the total population into two strata: public and private universities. In this study, the element under investigation is the students and the unit of analysis is the individual. According to Hoyle and Kenny (1999), there is no consensus in the literature about the appropriate sample size for the structural equation model (SEM); a sample size of 300 is considered appropriate to obtain reliable results from SEM [57].

3.3. Instrument Development

This study used 5 constructs: climate awareness, awareness of climate change issues, pro-environmental behavior, climate-friendly behavior, and environmental quality. This study developed an index to measure environmental awareness comprised of 7 questions that are adapted from Demaidi and Al-Sahili [19]. Similarly, this study measured climate change awareness with 5 indicators and climate-friendly behavior with 4, with the indicators of climate change awareness and climate-friendly behavior adapted from Demaidi and Al-Sahili [19]. Pro climate behaviors are measured with 9 questions adapted from Cleveland et al. [58], and environmental quality is measured with 7 questions adapted from Feng et al. [59]. A five-point Likert scale was used to measure the employed items of climate change awareness, climate-friendly behavior, pro-environmental behavior, and environmental quality. However, environmental awareness is used as a scale variable (see the questionnaire in Appendix A).

3.4. Data Analysis Technique

This study used the structural equation modeling partial least square approach (SEM-PLS) based on the Smart PLS version 3.3.5. In the first step, the study evaluates the measurement model to establish the reliability and validity of five constructs—climate awareness, awareness of climate change issues, pro-environmental behavior, climate-friendly behavior, and environmental quality—that are used in the conceptual model. Convergent validity is ensured by Cronbach's alpha, factor loadings, average variance extracted (AVE), and composite reliability (CR), while discriminant validity is determined by employing the Fornell–Larcker criteria and heterotrait and the monotrait (HTMT) data ratio. In the second step, this study employed a structural equation model (SEM) to examine the direct and indirect relationships among modeled variables. This study analyzed SEM by using a 500 bootstrap resampling.

4. Results and Discussion

This section is divided into two parts. First, we present summary statistics of the demographic profile of the respondents. Second, we assess the measurement model using confirmatory factor analysis (CFA).

4.1. Demographic Profile of the Respondents

The results of the demographic profile of the respondent are reported in Table 1.

The results indicate that, in this study, 57.6% of respondents are from public universities, while 40.4% are studying in private sector universities. Moreover, 79.4 % of students belong to Lahore, while 15.9% belong to cities other than Lahore. A total of 6.2% of students spent one academic year in university, 60.0% spent 2 years, 17.6% spent 3 years, and 10.2% spent four and above academic years in the university. A total of 42.7% of students studied one subject during their academic year, while 54.3% of students studied 2 or more subjects related to the environment during their academic year. A total of 65.9% of students belong to the natural sciences department, 27.2% are from the environmental science department, while 5.5% of students are from the social sciences department. A total of 27.5% of the students have a father whose income is below 30,000, 44.9% of the students have a father whose income is between 30,000 and 50,000, 18.6% of the students have a father whose income is between 51,000 to 80,000, and 8.9% of the students have a father whose income is above 80,000.

4.2. Assessment of Measurement Model
4.2.1. Confirmatory Factor Analysis (CFA)

This study employed CFA to check the reliability and validity of the constructs. The results of CFA are reported in Tables 2 and 3, while graphical representation of CFA is presented in Figure 2. The results of Table 2 indicate that the constructs of climate change awareness, climate-friendly behavior, pro-environmental behavior (CCA, AFB, PAFB), and environmental quality (EQ) are reliable and possess convergent validity because the value of factor loadings exceeded the recommended value of 0.40 for all items [60,61]. Moreover, all of the CR values exceeded the recommended value of 0.70 [62]. Results are consistent with Hair et al. [63], who recommended that the composite reliability coefficient should be at least 0.70 or more. Similarly, all of the Cronbach's alpha (α) values for the instrument are beyond the recommended values of 0.50 [57]. The results of Cronbach's alpha are in line with the criterion that a construct exhibits average reliability if the Cronbach's alpha coefficient value is 0.60, while a coefficient of 0.70 or higher indicates that the instrument has a high-reliability standard [64,65]. Moreover, the value of AVE is above 0.5, and the square root of AVE is greater than the correlation among the latent variables [66].

Table 1. Respondents' Demographic Profile.

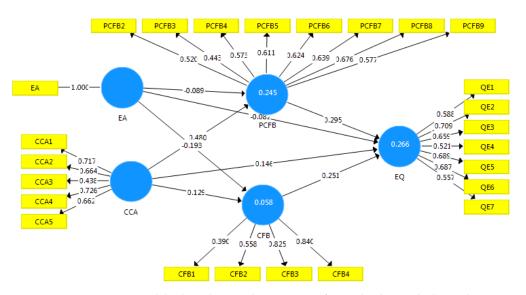| Variables	Frequency	Percent
Type of university		
Public	232	57.6
Private	163	40.4
Missing	10	2.0
Total	405	100.0
City		
Lahore	320	79.4
Others	64	15.9
Missing	21	4.7
Total	405	100.0
Years spent in university		
1 year	25	6.2
2 year	242	60.0
3 year	71	17.6
4 years and above	50	12.3
Missing	17	3.9
Total	405	100.0
Number of courses studied related to the environment		
1 course	173	42.7
2 and more	220	54.3
Missing	12	3.0
Total	405	100.0
Discipline		
Natural Sciences	267	65.9
Environment Sciences	110	27.2
Social Sciences	22	5.5
Missing	6	1.4
Total	405	100
Father's Income		
Below 30,000	111	27.5
30,000–50,000	181	44.9
51,000–80,000	75	18.6
Above 80,000	36	8.9
Missing	2	1.1
Total	405	100.0

Source: Authors' calculation.

Figure 2. Measurement Model. The values on the arrows are factors loadings which are also presented in Table 2. The values on path (arrows) are t-statistics that are also presented in Table 4.

Table 2. Construct Validity.

Construct	Indicators/Elements	Factor Loading	Variance Inflation Factor (VIF)	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Explained (AVE)
CCA	CCA1	0.717	1.356			
	CCA2	0.664	1.292			
	CCA3	0.438	1.071	0.651	0.781	0.522
	CCA4	0.726	1.31			
	CCA5	0.662	1.376			
CFB	CFB1	0.49	1.208			
	CFB2	0.558	1.295			
	CFB3	0.825	1.476	0.631	0.753	0.657
	CFB4	0.84	1.412			
PCFB	PCFB2	0.52	1.281			
	PCFB3	0.443	1.134			
	PCFB4	0.573	1.246			
	PCFB5	0.611	1.407			
	PCFB6	0.624	1.462	0.752	0.823	0.502
	PCFB7	0.639	1.4			
	PCFB8	0.676	1.414			
	PCFB9	0.577	1.314			
QE	QE1	0.588	1.247			
	QE2	0.709	1.515			
	QE3	0.659	1.434			
	QE4	0.521	1.366	0.725	0.806	0.744
	QE5	0.689	1.682			
	QE6	0.687	1.581			
	QE7	0.557	1.286			

Source: Authors' calculation.

Table 3. Discriminant Validity based on Fornell–Larcker Criteria and HTMT ratio of Correlations.

Variables	CCA	CFB	EA	EQ	PCFB
CCA	0.65				
CFB	0.149	0.676			
EA	−0.082	−0.195	1		
EQ	0.332	0.33	−0.184	0.634	
PCFB	0.487	0.123	−0.129	0.408	0.587
		Heterotrait Monotrait			
CCA					
CFB	0.29				
EA	0.107	0.24			
EQ	0.452	0.465	0.202		
PCFB	0.678	0.239	0.148	0.539	

Source: Authors' calculation. Note: HTMT value should be less than 0.85.

The results for discriminant validity are reported in Table 3. The results indicate that all diagonal values are greater than off-diagonal values, so discriminant validity exists among the constructs used in this study [67]. Discriminant validity was evaluated using the criteria suggested by Fornell and Larcker [66]. According to this, an AVE value higher than the correlation of a construct to other latent variables validates the discriminant validity of the construct. The results for discriminant validity indicate that all diagonal values are greater than off-diagonal values, so discriminant validity exists among the constructs used in this study. Moreover, this study also used the HTMT ratio of correlations to assess the discriminant validity of variance-based SEM. [67]. As shown in Table 3, the maximum HTMT value is 0.539, which is less than the most conservative critical HTMT

value of 0.85 [68]. Therefore, the result of HTMT also confirms that discriminant validity has been established.

Table 4. Results of SEM.

Path	Original Sample (OS)	Standard Deviation (STDEV)	T-Satistic ($\lvert OS/STDEV \rvert$)	*p*-Value	Decision
CCA -> CFB	0.129	0.061	2.102	0.036	Accepted
CCA -> EQ	0.146	0.06	2.441	0.015	Accepted
CCA -> PCFB	0.48	0.048	9.95	0.000	Accepted
CFB -> EQ	0.251	0.053	4.732	0.000	Accepted
EA -> CFB	0.193	0.058	3.322	0.001	Accepted
EA -> EQ	0.082	0.05	1.65	0.1	Accepted
EA -> PCFB	0.089	0.046	1.943	0.053	Accepted
PCFB -> EQ	0.295	0.055	5.337	0.000	Accepted
CCA -> CFB -> EQ	0.032	0.02	1.642	0.101	Accepted
EA -> CFB -> EQ	0.048	0.016	2.946	0.003	Accepted
CCA -> PCFB -> EQ	0.142	0.032	4.389	0.000	Accepted
EA -> PCFB -> EQ	0.026	0.015	1.774	0.077	Accepted

Source: Authors' calculation.

This study also examined the multicollinearity problem and reported the results in Table 3. The results indicate no problem of multicollinearity among all of the predictors' indicators because all values are far below the threshold level of five [69].

4.2.2. Partial Least Squares Structural Equation Modeling (PLS-SEM)

The PLS-SEM was conducted after the evaluation of the measurement model (see Figure 3). The significance of the PLS-SEM was assessed based on path coefficients, t-values, and standard errors. The hypotheses were tested by measuring direct and indirect effects through the bootstrapping procedure using Smart PLS-SEM version 3.0 [70], and resulst are reported in Table 4.
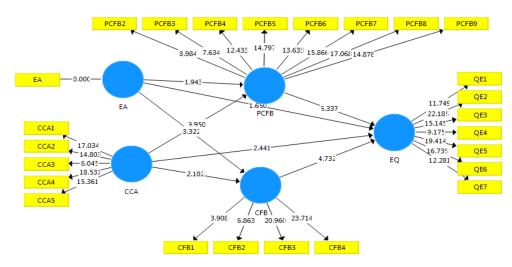

Figure 3. SEM Analysis. The values on path (arrows) are t-statistics that are also presented in Table 4.

The results in Table 4 indicate that climate change awareness (CCA) significantly and positively affects climate-friendly behavior and pro-environmental behavior (β = 0.129*, β = 0.48*). The results are consistent with Burgess et al. [10], who stated that more education about environmental issues helps to develop pro-environmentally friendly behavior; at the same time, some studies found that more education and more awareness did not help to develop pro-environmentally friendly behavior among individuals [71]. The discrepancies among these results indicate that environmental protective behavior is more complex and not easy to understand. This study extends the empirical literature by utilizing environmentally friendly behavior and pro-climate behavior, and contributes to the resolution of the empirical discrepancies. Moreover, this study also finds a positive and significant association between

climate change awareness and environmental quality (β = 0.146*). The results of this study are consistent with Kim and Hall [72], who conducted a meta-analysis and concluded that collaboration between natural and social scientists is necessary to develop awareness about climate issues and actions that bring adverse impacts on environmental quality. This study contributes to the empirical literature because it empirically investigated the impact of climate change awareness on environmental quality, with results indicating that the size of the impact of climate change awareness on environmental quality is moderate.

Similarly, environmental awareness significantly and positively affects environmental quality and pro-environmental behavior (β = 0.082**, β = 0.193*). Moreover, pro-environmental behavior significantly affects environmental quality (β = 0.295*). Indirect results indicate that pro-environmental behavior significantly mediates between climate change awareness and environmental quality (β = 0.295*), and between environmental awareness and environmental quality (β = 0.026*). Similarly, climate-friendly behavior also significantly mediates between climate change awareness and environmental quality (β = 0.032*), and between environmental awareness and environmental quality (β = 0.048*).

The results indicate that as environmental awareness increases, pro-environmental behavior and environmental quality will also increase, and vice versa. The results are consistent with Carducci et al. [41], who established that environmental pollution can be reduced by educating individuals and spreading information [42]. This study established that awareness, in turn, encourages individuals to behave in such a way that they are ready to take action to save the environment, which, resultantly, improves environmental quality. Aliman [43] indicated that environmental awareness motivates people to behave in an eco-protective way. Individuals are motivated to participate in any activity that helps to restore environmental quality. Moreover, the results also indicate that pro-environmental behavior significantly mediates between climate change awareness and environmental awareness.

After reviewing the literature, the present study figured out that environmental protective behavior is highly influenced by environmental awareness and climate change awareness [18,32], which, in turn, positively contributes to environmental quality [19,33]. Researchers argued that the more individuals are aware of the environmental and climate change issues, the more they will be engaged in climate-friendly and pro-environmental behaviors, which resultantly promote environmental quality. However, empirical research did not establish the mediating role of environmental protective behavior between the modeled variables. This study contributes to the empirical research by establishing the mediating role of environmental protective behavior among the modeled variables in the context of a higher education institution in Pakistan.

5. Conclusions and Policy Implications

This study was conducted to highlight the burning issue of the climate change phenomenon by observing awareness of the climate and climate change and its impacts on environmental protective behavior and on environmental quality. This study attempts to create the knowledge that awareness about climate change leads individuals to engage in climate-friendly and pro-environmental behaviors that ultimately contribute to environmental quality. The results obtained from a detailed empirical analysis contribute to the empirical literature significantly by investigating, first, the effects of awareness of the environment and climate change issues on environmental protective behavior; second, the impact of awareness of the environment and climate change on environmental quality; and third, the mediating role of climate protective behavior between awareness of the climate and environmental quality, and between awareness of environmental change and environmental quality.

The study found that awareness of the climate and climate change significantly and positively affects climate-friendly behaviors, pro-environmental behaviors, and environmental quality. Similarly, awareness of the climate and climate change significantly and positively affects environmental quality. Moreover, the study found that climate-friendly behaviors and pro-environmental behaviors significantly affect environmental quality. Indirect results indicate that pro-environmental behaviors significantly mediate between

awareness of climate change and environmental quality and between awareness of the climate and environmental quality. Similarly, climate-friendly behaviors significantly mediate between environmental awareness and environmental quality, and between awareness of climate change and environmental quality.

The findings of this study suggest that it is important to enhance environmental awareness and the awareness of climate change among students to develop their environmentally friendly behaviors and to save the environment's quality. This study helps policymakers to control environmental degradation by organizing individual climate action through the spread of awareness about the environment and climate change, thus also helping the nation to achieve sustainable economic development.

Limitations and Future Research Direction

This study contributes to the theoretical literature by developing a model that explains how awareness of the climate and climate change affect climate protective behavior, which ultimately affects environmental quality. However, this study did not utilize demographic and psychological factors that can affect climate protective behavior and environmental quality. So, in the future, researchers can develop a model by incorporating the drivers of awareness of the environment and climate change to promote environmental quality. Moreover, this study is conducted on students of different disciplines, while future studies can be conducted on small-medium enterprise managers and consumers to explain the phenomenon. Furthermore, this study is quantitative, while a qualitative study can be conducted to achieve the in-depth study of the phenomenon.

Appendix A

Questionnaire
Demographic Information

1. Name: —————
2. Name of University: ——————-
3. City

    1. Lahore
    2. Other than Lahore

4. Discipline: ——————

    1. Natural sciences
    2. Social sciences
    3. Environmental sciences

5. Type of university

    1. Public
    2. Private

6.   Years spent in university

- 1 year
- 2 years
- 3 years
- 4 and above years

7.   Number of courses learned related to the environment

- one course
- 2 and more

8.   Father Income

- below 30,000
- 30,000-50,000
- 51,000-80,000
- above 80,000

Environmental Awareness

1.   Do you read or watch environmental topics?

1.   Yes
2.   May be
3.   No

2.   Do you attend environmental events?

1.   Yes
2.   May be
3.   No

3.   Do you participate in environmental activities?

1.   Yes
2.   May be
3.   No

4.   Are you interested in participating in associations or organizations related to the environment?

1.   Yes
2.   May be
3.   No

5.   Do you consider buying products made of recyclable materials?

1.   Yes
2.   May be
3.   No

6.   Do you use recyclable bags for shopping?

1.   Yes
2.   May be
3.   No

7.   Do you apply waste recycling?

1.   Yes
2.   May be
3.   No

Climate Friendly Behaviors

1.   What is your daily transportation method?

1.   Public transportation
2.   Private transportation
3.   Walking

    4.   Cycling

2.   What do you do with your leftover food?

    1.   Throw it away
    2.   Keep it and use it next day
    3.   Use it to feed my pets

3.   Do you prefer paper books or e-books?

    1.   Paper books
    2.   E-books

4.   Do you prefer to use plastic bags or paper bags?

    1.   Plastic bags
    2.   Paper bags

Please specify how strongly you agree or disagree with each given statements by the scale provided. Check (√) the corresponding number alongside each statement.
1 = Strongly Disagree (SD)
2 = Disagree (D)
3 = Neutral (N)
4 = Agree (A)
5 = Strongly Agree (SA)

Indicators	1	2	3	4	5
Climate Change Awareness					
I can define climate change					
I follow and search environment and climate change topics					
Behavior and actions of each individual can help to prevent climate change					
Climate change affects me and my surrounding negatively					
I am willing to learn best practices to improve air quality					
Air Quality					
Reduction in waste of water improves air quality					
Reduction of solid wastes improve air quality					
Decrease in consumption for hazardous/harmful/toxic materials improves air quality					
Decrease in frequency for environmental accidents improve air quality					
Reduced emission of greenhouse gases into the environment help to save environment					
Increased volume of recycled materials used products help to save environment					
Minimization of energy consumption and increased rate of renewable energy consumption improve air quality					
Pro-environmental Behaviors					
I turn off all lights before leaving the house					
I buy more expensive, but more energy efficient light bulbs					
I walk rather than driving to a store that is just a few blocks away					
I refuse to buy products from companies accused of being polluters					
I use the blue or green box (bag) for recycling					
I always donate to climate change movements					
I start using GHG-free items					
I start reducing gasoline use					
I start using solar energy					

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