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### Fostering Environmental Friendly Habits through Awareness Intervention: An Experimental Study to analyze SDG 12

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#### Chronicle

#### Abstract

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Climate change is a trending issue all over the world, and it is important to protect the environment to save future generations. Our positive intention towards pro-environmental behavior causes a significant outcome in reducing environmental degradation. At the same time, irresponsible behavior leaves serious consequences for natural resources in the future. The leaders, policymakers and researchers are putting their efforts into mitigating climate change. The purpose of this study is to explore the impact of environmental awareness intervention on pro-environmental habits among employees of a public sector university in Pakistan. The findings stated that a positive change had been seen after intervention in water conservation, energy conservation, recycling, economic concern, health concern, environmental concern and environmental awareness. The study concluded that awareness plays a significant role in adopting pro-environmental habits. Moreover, future researchers can extend this study to a larger area and time.

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## INTRODUCTION

Human irresponsibility causes most environmental problems. To meet sustainability goals and keep humans safe on earth, individuals and leaders at all levels must change their behavior quickly (Steffen et al., 2015). Although climate change knowledge is expanding, unsustainable habits add to Pakistan's environmental concerns. From 4.5 million in 2000 to 15 million now, private vehicle ownership has skyrocketed. This raises commuter emissions. Since 1990, per capita power usage has increased 28%. Deforestation continues, leaving 5.4% forest cover. Nearly half of Pakistanis' 0.5kg daily waste is discarded and burned. Pakistan uses the fourth-most water per person in the world at 240 liters per day. Industrial and agricultural practices damage water supplies. Only 27% believe government is dedicated to climate change, but 77% are eager to take personal action (Stavrianakis, 2021). Pakistan needs major educational, policy, and cultural changes to change unsustainable consumerism and environmental behavior. Behaviors underpin many of our daily actions, making them hard to change. People often repeat habits without thinking (Wood & Runger, 2016). Our daily decisions do not exclusively cause our bad habits. Past choices have affected our current actions and lifestyles. Because our decisions today shape our bad habits. Pro-environmental behavior

studies rarely consider behavior. These studies stress values, norms, attitudes, objectives, and motivations for pro-environmental action. Thus, most interventions that aim to change behavior permanently promote intrinsic motivation through information gain, feedback, and monitoring. However, these methods may not affect behavior permanently (Verplanken & Aarts, 1999). Behavior may hinder the integration of intrinsic motivation with sustainable behavior and limit attitude behaviors (Jackson, 2005; Kollmuss & Agyeman, 2002). The behavior is neglected in sustainability science. Sustainability science focuses on integrating intrinsic motivation with sustainable behavior (Verplanken & Aarts, 1999). A Scopus search on January 26, 2021, found that less than 0.5% of the 596 653 papers in the large body of sustainability research contain "behavior" in their titles, abstracts, or keywords. Only 3% of the 2719 research articles on pro-environmental behavior discuss behavior. Most of these articles either mention habits briefly, use "behavior" to mean any action, or quantify habits based on prior behavior. Efforts to enhance attitude-behavior models by incorporating behavior have been made to enhance prediction accuracy (Aboelimged, 2021; Bell & Ulhas, 2020).

Huang, Wen, and Gao (2020) and Russell and Knoeri (2020) investigated behavioral drivers or obstacles to pro-environmental behavior, while others use habit theory to develop behavior-specific interventions. Few articles explain how behavior affects sustainability. White, Habib, and Hardisty (2019) proposed a behavior-based framework for sustainability transformation interventions. For this article, research was limited to "pro-environmental behavior," however other categories like "green behavior," "sustainable behavior," and specific activities like "recycling" are likely also considered. Our research shows that most academics don't care about ecologically friendly activities. This is surprising given the potential impact habits may have on behaviors that may soon need significant change.

Behaviors are often described without a description to measure past behavior (Southerton, 2013). Kurz, Gardner, Verplanken, and Abraham (2015) said that behavior involves practice, automatic regulation, and context adaptation. They called actions "memory-based tendencies to respond automatically to specific cues." It is vital to notice that actions vary and that the books offer varied perspectives. Two perspectives exist in the books. So, social scientists describe behavior by more than just a situation. They view conduct as continually changing, crucial to social dynamics and sophisticated dynamics that cannot be divorced from the person's surroundings. Climate change is a global issue. Climate change accelerates daily. Wasted natural resources cause climate change. Resources include water, energy, and trees. Pakistan suffers from climate change. Islamia University Bahawalpur has widespread natural resource waste. Water, energy, or paper. Our study examines IUB employees' pro-environmental conduct. The objective of this study is to examine the effect of environmental awareness interventions on the pro-environmental behavior of IUB employees. This will be the first study to analyse the pro-environmental habits of employee's behavior on a sustainable university campus. This study will help university employees understand the environmental and climate change threats for future generations. This study will help us to check the pro-environmental habits and level of environmental awareness among university employees. If they were not using the environmental resources efficiently, then this study will help them make the policy recommended. If they were unaware of climate change issues, then this study will also play a significant role in increasing their pro-environmental habits. This study will make the IUB a sustainable university campus.

## LITERATURE REVIEW

The research under review found one-year changes in pro-environmental behavior before and after education initiatives. Rosenthal (2018) examined how procedural knowledge affected recycling over the course of a month. Huber, Viscusi, and Bell (2020) evaluated US residence recycling trends over five years. Bordner, Ferguson, and Ortolano (2020) examined children's environmental attitudes and manners. The US support for self-reported environmental actions and policies between 1997 and 2012 was analyzed (Xiao & Buhrmann, 2019). Authors of behavioral spillover studies have analyzed earlier behavior. They used a time series. Positive spillovers indicate that one eco-friendly behavior inspires others. Negative spillovers reduce pro-environmental behavior. However, long-term patterns in pro-environmental behavior must be examined to see if people have become more ecologically conscious. Bordner et al. (2020) evaluated environmental concern shifts and pro-environmental behavior drivers. Whitmarsh and Capstick (2018) explored climate change anxiety, skepticism, and perception and their causes. We know of no studies that have evaluated changes in values, perceptions, awareness, and environmental responsibility that influence pro-environmental behavior.

Kaiser and Shimoda (1999) predicted eco-conscious behavior using environmental views. They found that interest in doing things in an environmentally friendly way could explain 75% of the variation, and that environmental values and knowledge could explain 40%. Environmental awareness predicted eco-friendly behavior. Individual environmental knowledge accounted for 55% of environmental behavior variation, while guilt sentiments caused by environmentally damaging activity accounted for 44%. Tilikidou and Delistavrou (2008) found a negative link between Greek consumers' environmentally conscious behavior and environmental unconcern and that educated women were more likely to take pro-environment actions. Fraj and Martinez (2007) found that environmental views predict eco-friendly behavior using a structural equation model. Kapassa, Abeliotis, and Scoullou (2013) discovered that married, middle-aged college graduates were more likely to buy environmentally friendly products and pay more for them. Tilikidou (2007) found a positive correlation between ecologically conscious consumption and environmental knowledge and a negative correlation with environmental unconcern. Tilikidou and Delistavrou (2008) examined why individuals don't buy eco-friendly products and their causes.

They found that those with higher education prioritized environmental concerns over consumerism, recycled more, and participated in ecologically oriented activities more. Welsch and Kühling (2009) discovered that cognitive and economic factors affected ecologically oriented consumption, and that long-term buyers of environmentally friendly foods were more inclined to buy them again. Kaiser and Wilson (2000) found that the general ecological behavior scale may evaluate ecological behavior in Californian and Swiss students. A behavior-based attitude measure for adolescents using earlier behavior records (Kaiser, Oerke, & Bogner, 2007). A Rasch-type model showed that self-reported conservation practices can effectively predict environmental sentiments. They believed that reported and likely conservation-related acts could reveal people's environmental opinions. Because it shows a statistically formalized link between a person's attitude and conduct history, their proposed measure has several psychological science-based policy help applications. A measure measuring environmental attitudes for high school students,

and its reliability and validity were examined (Uzun & Sağlam, 2006). Factor analysis was used to extract environmental behavior and opinion factors. The factors retrieved were environmental concerns and awareness. Despite being established by high school students, the scale can be utilized with middle schoolers. Shobeyri, Omidvar, and Prahallada (2007) compared Iranian and Indian middle schoolers' environmental awareness. A survey involved 513 female and 476 male students from 103 Tehran and Mysore middle schools. There were significant discrepancies in environmental awareness between Iranian and Indian students. Male and female pupils' environmental awareness was similar in the poll. School administration has a big impact. An analysis of the impact of environmental awareness and pro-environmental actions on purchasing eco-friendly food goods using a structural equation model (Arı & Yılmaz, 2017). Environmental awareness did not affect ecological behavior, however environmental attitudes did enhance the likelihood of buying eco-friendly products. Steg and Vlek (2009) stated that environmental ideas are necessary to understand pro-environmental behavior, and these attitudes will affect behavior. Dono, Webb, and Richardson (2010) found a high link between university students' environmental opinions and behavior.

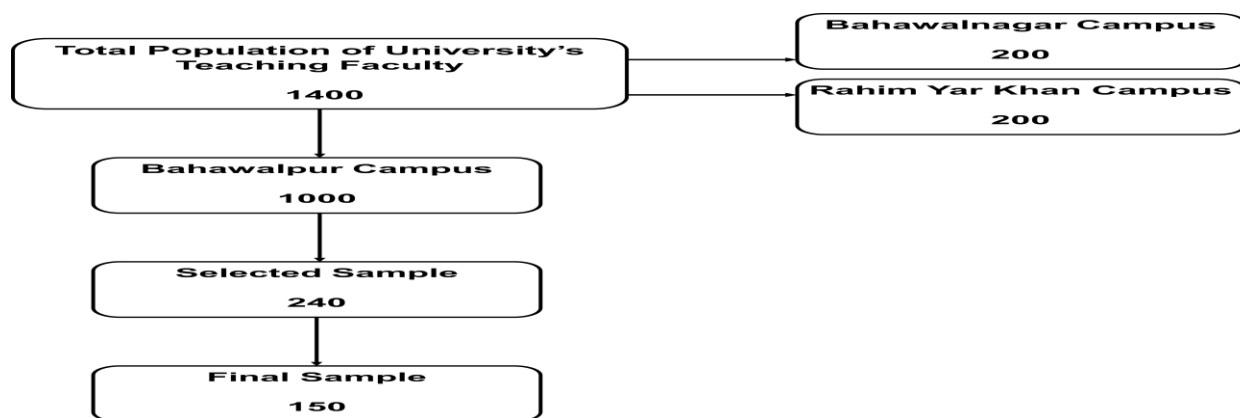
Abeliotis, Goussia-Rizou, Sdrali, and Vassiloudis (2010) examined how Greek families raise their children's environmental awareness. The parents of 435 primary school seniors in the Athens urban zone were asked to complete a closed-ended questionnaire for their study. Greek families believe children's character development depends on environmental awareness. Participants also said their daily activities made their kids more environmentally aware. Cluster analysis split families into five categories based on daily activity responses. Data shows that highly educated young mothers are more eco-friendly than others. (Kapassa et al., 2013) examined middle schoolers' sustainable raw material and biomass knowledge, attitudes, and beliefs. To promote green chemistry, they examined the relationships between renewable biomass source beliefs, knowledge, and attitudes and their applications. Schools in Greece teach these disciplines. Students had major knowledge gaps about biomass production and green chemistry. Students were required to be committed and positive about biomass utilization. Studies on parenting and environmental views show that mothers care more about environmental issues than males. This gap is explained by their social statuses. Fathers were more concerned with financial and economic issues, while moms were more concerned with family members' health and wellness, which are closely linked to local environmental factors like water, air, and solid waste. Higher education raises environmental awareness and concern, according to studies.

Relying on our emotions may not always be ideal. We have troubles when we establish unpleasant behaviors that are hard to stop, when our gut instincts lead us to make prejudiced or erroneous conclusions, or when we unhappily react to our emotions. We face difficulties in these instances. Behaviors are harder to "undo" than intentional behavior. Behaviors are controlled by separate brain networks than intentionality. When a habit becomes second nature, we no longer follow our planned outcomes and are more likely to keep it despite our best efforts (Miller, Shenhav, & Ludvig, 2019). Emmons once said, "A person's habits might make them excellent workers or terrible bosses" (Edwards, 1891). When a habit is unstable or people are extremely motivated and proficient at adapting their reactions to specific situations, constant goal-setting is necessary to change. Motivation and competence at adapting to circumstances can

also cause change. Motivation alone seldom changes deeply rooted behavior because self-control varies with time. Due to time limits, diversions, tension, hunger, and addiction, people struggle to think clearly and actively choose their behavior. These factors favor predetermined automatic behavior (Rebar, Gardner, Rhodes, & Verplanken, 2018). Behaviors are commonly written about even without a specific description (Southerton, 2013), usually as a measure of prior conduct. Kurz et al. (2015) stated that behavior has three main components: practice, automatic regulation, and environmental and contextual influences. (Rebar et al., 2018) described behaviors as "memory-based tendencies to respond automatically to specific cues," which are honed by repetition in predictable environments. Climate change is a substantial worry, as evidenced by the literature studied. Several studies have been conducted on this subject in the past. The goal of our study is to examine the behavior of IUB employees following several environmentally friendly actions. The goal of our study is to see if either intervention can result in a favorable change in their behavior.

### DATA AND METHODOLOGY

This study used an experimental design, which compared two or more variables by having one or more groups undergo different conditions and then analyzing the results to conclude the relationships between the independent and dependent variables. There are three types of research designs, and our study employs the pre-experimental design. Data was collected in two phases: pre-intervention and post-intervention. The gap between the 1<sup>st</sup> and 2<sup>nd</sup> data collection stage was of 6 months. Data was collected through emails. Pre-intervention data was collected in April 2022. After the 1<sup>st</sup> time data collection, an intervention was made in the form of awareness campaigns (in the form of poster campaigns, sessions and seminars) with a perception to create a positive impact on the behavior of the university's employees. Post-intervention data were collected in November 2022. After both data collections, data were analyzed through the paired sample t-test in Excel. The respondents of our study were permanent teaching faculty of the university. A sample of 240 teacher staff was finalized to collect data for this study. Moreover, they were classified as Lecturers, Assistant Professors, Associate Professors and Professors. Our total population contains 240 teachers. The information related to the population is displayed in Figure 1.



**Figure 1.**  
**Data of Population**

According to Krejcie and Morgan (1970) table, your sample size must be 148 or 148+ if

your population is 240. In the end, 150 teachers were used as respondents. Respondents used in this study have different age groups, designations and residential backgrounds. The baseline survey was scheduled for April 2022. Respondents received the questionnaire through email. Following the initial data, 6-month weekly interventions were administered. Once the intervention period was over, post-intervention data was collected in November 2022.

### Environmental Awareness Intervention



Figure 2. Different forms of Environmental Awareness Interventions

## Operationalization of Pro-Environmental Habits

The figure 2 outlines the various dimensions of pro-environmental habits and their corresponding indicators organized at the Islamia University. These dimensions represent different aspects of environmentally conscious behavior that were investigated in the current study. Energy conservation indicators represent actions related to energy-saving practices, such as turning off heating/air conditioning in unused rooms, using efficient lighting, switching off lights and electronics when not in use, and purchasing energy-efficient appliances. Similarly, the indicators measuring water conservation involve behaviors associated with water-saving efforts, such as controlling water usage while showering, turning off taps when brushing teeth, and minimizing water wastage. Recycling related indicators encompass actions linked to recycling and reusing materials, like reusing recyclable materials, segregating recyclable items, looking for ways to repurpose items, and opting for used or refillable products.

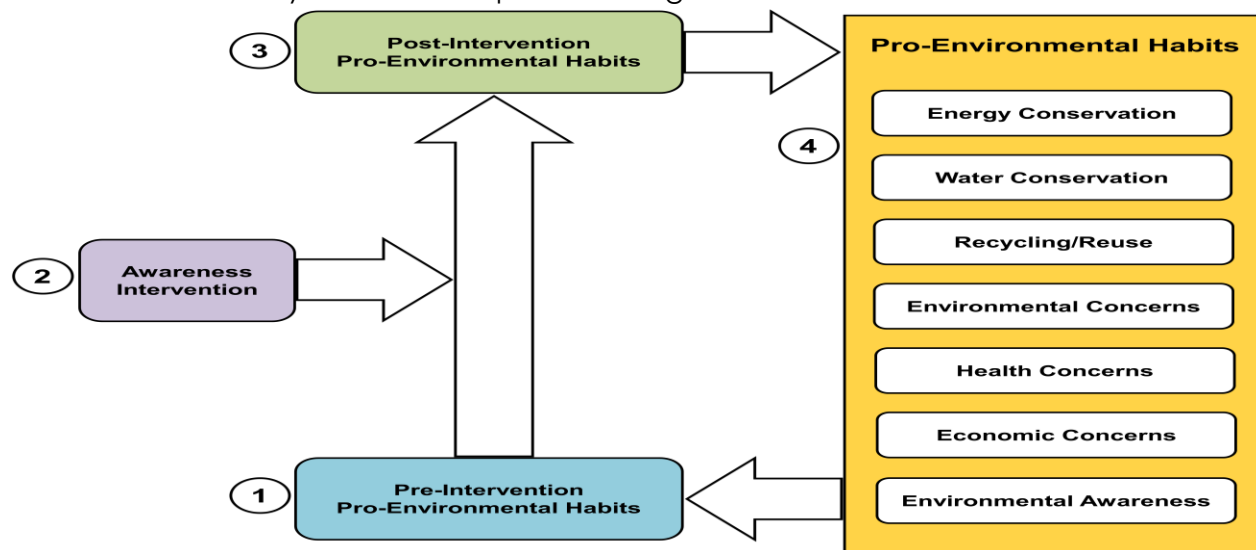
Environmental concern reflects respondents' attitudes and beliefs about environmental issues, including acknowledging human impact on nature, considering the consequences of interfering with the environment, and expressing concern about the state of the environment. Health concern pertains to the respondents' interest in health-related information, reading health-related articles, and paying attention to food labels. Economic concern relates to financial attitudes and behaviors, such as prioritizing saving money, delaying purchases for savings, making resourceful financial decisions, and being mindful of spending. Environmental awareness is measured through the indicators capturing the respondents' awareness and beliefs regarding environmental issues, pollution's impact on health, species extinction, climate change, and the value of environmental protection for the future. Information on each indicator was collected using a five-point Likert scale. Respondents were asked to rate their agreement or disagreement with each statement on the scale, with scores ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This scale allowed researchers to quantify the participants' responses and measure their pro-environmental habits along the various dimensions before and after the awareness intervention.

<b>Pro-Environmental Habits: Dimensions and Indicators</b>	
<b>Dimensions</b>	<b>Indicators</b>
<b>Energy Conservation</b>	I turn the heat/air conditioning and system off in unused rooms. I keep heating/air conditioning low to save energy. I buy high efficiency but expensive lights and blubs to save energy. I switch off the light whenever leaving the room. I switch off lights or electronic equipment if I am not using them. Buy energy efficient appliances to reduce electricity consumption.
<b>Water Conservations</b>	I control the water use when taking a shower. I try to save water while adjusting its temperature. I turn off the tap when brushing the teeth. I have a short shower even when larger one is desired. I turn off the tap when I see water flowing uselessly. I save water at home.
<b>Recycling</b>	I reuse recyclable materials like newspaper, cans or bottles. I keep my garbage in separate piles of glass, plastic paper metal for recycling. I look for ways to reuse things. I purchase used furniture. I purchase refillable products. I purchase recyclable products.

<b>Environmental Concern</b>	Human are harming the natural environment. People are only sharing the earth with other creatures and we have no right to use it as a suits us. When humans interfere with nature, it often produces disastrous consequences. I am extremely worried about the state of the world's environment and what it will mean for my future.
<b>Health Concern</b>	I am interested in information about my health. I read more health- related articles than I did 3 years ago. I usually read the ingredients on food labels.
<b>Economic Concern</b>	I am willing to wait on a purchase I want so that I can save money. There are things I resist buying today so I can save for tomorrow. I discipline myself to get the most from my money. Making better use of my resources makes me feel good. I believe in being careful in how I spend my money.
<b>Environmental Awareness</b>	The effects of pollution on public health are worse than we realize Over the next several decades, thousands of species will be finished from the earth Claims that current levels of pollution are changing earth's climate are exaggerated Environmental protection will provide a better world for me and my children

**Note:** Information on each indicator was recorded on a five-point Likert scale. The response obtained a score 1 if the answer was Strongly Disagree, score 2 if answered Disagree, score 3 if answered Neutral, score 4 if answered Agree, and score 5 if the answer was Strongly Agree

The study aimed to assess how the awareness intervention influenced respondents' attitudes and behaviors in these dimensions, which would be reflected in the changes in their Likert scale scores from pre-intervention to post-intervention. This approach provided a structured and quantifiable way to evaluate the impact of the intervention on the participants' pro-environmental habits. Study was conducted among teaching faculty members of a government sector university in Pakistan. The study aimed to explore the pre-intervention and post-intervention effects of an awareness intervention, which involved poster campaigns, sessions, and seminars, on the respondents' pro-environmental habits. A schematic diagram presenting the objective of the study is given below. The summary of the text explained in Figure 3.



**Figure 3.**  
**Pro-Environmental Habits Before and After Environmental Awareness**  
 Source. Author's own calculation



## The Study Area

The Islamia University of Bahawalpur is located (university's Cartesian coordinates are 29.272° N, 71.833° E) in the city of Bahawalpur, Pakistan. University covers an area of 1250 acre. It is a public university that was founded in 1975. The university offers a wide range of undergraduate and graduate programs in a variety of fields.

**Table 1**  
**Demographic Profile**

Item	Option	Percentage
Gender	Male	70%
	Female	30%
Age	25-40 Years	55%
	41-50 Years	35%
	51-60 Years	10%
Designation	Lecturer	40%
	Assistant Professor	30%
	Associate Professor	20%
	Professor	10%
Residential Background	Rural	60%
	Urban	40%

## Paired Sample t-test for the comparison of means

A statistical hypothesis test in which the test statistic conforms to a student's t-distribution under the null hypothesis is called a t-test. There are five different kinds of t-tests. The t-test for paired samples was used in this study. If there is a one-to-one correspondence between each observation in one sample and an observation in the other sample, then the means of the samples can be compared using a paired sample t-test.

## Reliability and Validity

The reliability of a measurement is defined as its consistency and stability through time, between independent raters or observers, and across measurement versions. A reliable measurement tool produces constant outcomes when used under controlled conditions. Convergent validity of a group of measures or indicators can be assessed with the use of AVE, a statistical metric. Acceptable convergent validity typically requires an AVE of 0.5 or above, though this threshold may shift depending on the study's aims and the nature of the concept being assessed. If the AVE is less than 0.5, the measurements may not be adequately capturing the intended concept, and they may need to be revised. Except this, value of Cronbach's alpha, Composite reliability (rho\_a) and Composite reliability (rho\_c) was greater from 0.7, 0.75 and 0.75 respectively. As seen in table 2. It has been seen that all the values have higher than their minimum standard value. So, that's why reliable and variable data was used in this research.

**Table 2.**  
**Reliability and Validity**

	Cronbach's alpha	Composite (rho_a)	reliability	Composite (rho_c)	reliability	Average variance extracted (AVE)
EA	0.746	0.765		0.786		0.501
EC	0.717	0.775		0.811		0.505
ECC	0.749	0.75		0.833		0.512
ENC	0.761	0.77		0.797		0.516

HC	0.771	0.77	0.773	0.529
R	0.701	0.797	0.745	0.528
WC	0.75	0.785	0.773	0.534

### Discriminant Validity-Heterotrait-monotrait Ratio (HTMT)

Discriminant validity refers to the extent to which a measure is distinct from other constructs that are theoretically unrelated. The HTMT ratio is a ratio of the correlation between two different constructs to the correlation between two measures of the same construct. The ratio is expected to be smaller than 0.90 to demonstrate discriminant validity. When the ratio is close to or greater than 0.90, it suggests that the measure is not distinct from other constructs and may be measuring something other than the intended construct. From table no.3, it has been observed that values of all the factors remain between 0 and 0.90. It also concluded from the table. 3 that discriminant validity is significant and variables are highly correlated.

**Table 3.**  
**HTMT**

	EA	EC	ECC	ENC	HC	R	WC
EA							
EC	0.473						
ECC	0.722	0.329					
ENC	0.739	0.395	0.552				
HC	0.791	0.269	0.876	0.842			
R	0.603	0.51	0.663	0.673	0.58		
WC	0.496	0.688	0.576	0.691	0.838	0.682	

### Discriminant Validity- Fornell-Larcker Criterion

Fornell-Larcker criterion is a common method for assessing the discriminant validity of constructs in a study. The Fornell-Larcker criterion involves running a confirmatory factor analysis (CFA) and examining the correlation matrix of the factors. The Fornell-Larcker criterion involves two steps. First, we estimate a CFA with all the items for each construct. Second, we examine the correlation matrix of the factors, and we calculate the square root of the variance explained by each factor. Then, we compare the correlation coefficients between each pair of factors to the square roots of the variance explained by each factor. If the correlation coefficient is smaller than the square root of the variance explained by each factor, then discriminant validity is supported. It has been seen from the results that the square root of all the variances has higher than the correlation coefficient in each factor.

**Table 4.**  
**Fornell Lickerian**

	EA	EC	ECC	ENC	HC	R	WC
EA	0.693						
EC	0.353	0.659					
ECC	0.5	0.235	0.708				
ENC	0.491	0.253	0.401	0.704			
HC	0.417	0.142	0.454	0.411	0.647		
R	0.413	0.34	0.471	0.449	0.265	0.573	
WC	0.349	0.464	0.431	0.483	0.47	0.442	0.612

### Discriminant Validity-Cross Loadings

Cross-loadings refer to the degree to which an item on a scale load on its intended construct as well as on other constructs. If an item has high loadings on its intended construct but low loadings on other constructs, then it is said to have good discriminant validity. To assess cross-loadings in CFA, researchers typically compare the fit of a model in which all items load only on their intended constructs (the "constrained" model) to the fit of a model in which items are allowed to cross-load on other constructs (the "unconstrained" model). If the constrained model fits the data significantly better than the unconstrained model, then it provides evidence for discriminant validity. The significance of cross-loadings depends on the context of the analysis and the research question being addressed. From table 5. all the cross loadings have at least 0.4 on one factor and a loading of less than 0.4 on all other factors to be considered a reliable and valid measure of that factor.

**Table 5.**  
**Cross Loadings**

	EA	EC	ECC	ENC	HC	R	WC
EA1	0.759	0.319	0.332	0.431	0.409	0.333	0.272
EA2	0.739	0.294	0.38	0.297	0.19	0.342	0.258
EA3	0.642	0.157	0.373	0.421	0.315	0.212	0.246
EA4	0.622	0.162	0.318	0.201	0.245	0.227	0.183
EC1	0.1	0.294	0.04	0.134	0.116	-0.01	0.177
EC2	0.283	0.718	0.187	0.122	0.048	0.145	0.328
EC3	0.11	0.519	0.112	0.235	0.004	0.227	0.309
EC4	0.294	0.718	0.142	0.098	0.087	0.233	0.273
EC5	0.223	0.788	0.182	0.21	0.14	0.368	0.354
EC6	0.298	0.776	0.207	0.237	0.164	0.291	0.376
ECC1	0.324	0.127	0.667	0.222	0.388	0.269	0.362
ECC2	0.287	0.096	0.707	0.256	0.288	0.351	0.298
ECC3	0.32	0.173	0.691	0.304	0.241	0.387	0.263
ECC4	0.441	0.251	0.686	0.367	0.319	0.314	0.291
ECC5	0.392	0.178	0.781	0.266	0.374	0.338	0.313
ENC1	0.356	0.146	0.251	0.687	0.364	0.282	0.373
ENC2	0.262	0.191	0.272	0.649	0.18	0.354	0.267
ENC3	0.36	0.239	0.17	0.699	0.217	0.233	0.279
ENC4	0.399	0.152	0.403	0.776	0.372	0.379	0.422
HC1	0.251	0.123	0.328	0.289	0.801	0.229	0.43
HC2	0.356	0.076	0.33	0.316	0.462	0.098	0.171
HC3	0.289	0.069	0.263	0.239	0.633	0.156	0.239
R1	0.308	0.249	0.369	0.318	0.18	0.64	0.339
R2	0.101	0.126	0.197	0.174	0.144	0.502	0.236
R3	0.25	0.232	0.291	0.245	0.172	0.603	0.221
R4	0.152	0.14	0.154	0.246	0.024	0.551	0.185
R5	0.289	0.187	0.282	0.318	0.178	0.553	0.284
R6	0.238	0.191	0.252	0.192	0.179	0.58	0.21
WC1	0.183	0.434	0.241	0.215	0.208	0.269	0.511
WC2	0.282	0.325	0.466	0.364	0.312	0.461	0.686
WC3	0.23	0.367	0.348	0.323	0.386	0.286	0.78
WC4	0.072	0.042	0.045	0.251	0.265	0.231	0.343
WC5	0.297	0.226	0.17	0.376	0.317	0.101	0.659
WC6	0.129	0.281	0.151	0.157	0.159	0.22	0.595

### Post Data Analysis

The data that was taken 2nd time analyzed through the Smart PLS 4. Structural Equation

Modelling is used to analyze the data.

### Reliability and Validity

The reliability of a measurement is defined as its consistency and stability through time, between independent raters or observers, and across measurement versions. A reliable measurement tool produces constant outcomes when used under controlled conditions. Reliability can be evaluated in a variety of ways; some common ones include test-retest consistency, inter-rater consistency, and internal consistency. On the contrary, validity relates to how well a given measure assesses its target construct. There should be no room for error or bias in a legitimate measure, such that the results are an accurate reflection of the notion or construct being measured. Content validity, criteria validity, and construct validity are all forms of validity.

**Table 6.**  
**Discriminant Reliability and Validity**

	Cronbach's alpha	Composite (rho_a)	reliability	Composite (rho_c)	reliability	Average variance extracted (AVE)
EA	0.723	0.724		0.733		0.508
EC	0.782	0.799		0.79		0.591
EC C	0.786	0.797		0.795		0.538
EN C	0.797	0.758		0.75		0.545
HC	0.718	0.738		0.789		0.549
R	0.763	0.756		0.769		0.581
WC	0.767	0.799		0.781		0.585

**Table 7.**  
**Discriminant Validity-Heterotrait-monotrait Ratio (HTMT)**

	EA	EC	ECC	ENC	HC	R	WC
EA							
EC	0.683						
ECC	0.838	0.671					
ENC	0.81	0.548	0.578				
HC	0.863	0.627	0.678	0.701			
R	0.602	0.469	0.722	0.455	0.597		
WC	0.806	0.871	0.682	0.57	0.857	0.522	

**Table 8.**  
**Discriminant Validity- Fornell-Larcker Criterion**

	EA	EC	ECC	ENC	HC	R	WC
EA	0.639						
EC	0.438	0.625					
ECC	0.533	0.484	0.662				
ENC	0.46	0.374	0.38	0.667			
HC	0.542	0.409	0.379	0.417	0.67		
R	0.303	0.234	0.479	0.185	0.247	0.53	
WC	0.493	0.638	0.483	0.404	0.482	0.282	0.62

**Table 9.**  
**Discriminant Validity-Cross Loadings**

	EA	EC	ECC	ENC	HC	R	WC
EA1	0.645	0.251	0.369	0.405	0.296	0.314	0.221
EA2	0.6	0.193	0.321	0.227	0.337	0.287	0.223
EA3	0.621	0.221	0.283	0.25	0.315	0.132	0.37

EA4	0.685	0.413	0.383	0.294	0.421	0.089	0.411
EC1	0.192	0.622	0.236	0.185	0.239	0.053	0.326
EC2	0.357	0.722	0.329	0.202	0.309	0.121	0.464
EC3	0.15	0.435	0.174	0.229	0.156	0.133	0.245
EC4	0.339	0.622	0.296	0.221	0.339	0.243	0.395
EC5	0.318	0.709	0.371	0.286	0.202	0.124	0.41
EC6	0.231	0.601	0.356	0.28	0.261	0.185	0.498
ECC1	0.208	0.279	0.58	0.244	0.132	0.162	0.255
ECC2	0.4	0.339	0.68	0.27	0.244	0.318	0.318
ECC3	0.276	0.168	0.653	0.217	0.189	0.353	0.177
ECC4	0.48	0.418	0.718	0.246	0.397	0.379	0.445
ECC5	0.32	0.33	0.669	0.283	0.213	0.335	0.327
ENC1	0.28	0.296	0.221	0.666	0.244	0.167	0.204
ENC2	0.22	0.087	0.15	0.372	0.047	0.042	0.046
ENC3	0.368	0.265	0.303	0.719	0.37	0.026	0.281
ENC4	0.364	0.286	0.314	0.825	0.34	0.201	0.407
HC1	0.478	0.459	0.272	0.403	0.873	0.161	0.443
HC2	0.275	0.015	0.192	0.229	0.374	0.109	0.182
HC3	0.321	0.167	0.327	0.181	0.668	0.247	0.285
R1	0.117	0.104	0.234	0.008	0.039	0.54	0.126
R2	0.216	0.186	0.187	0.177	0.237	0.409	0.216
R3	0.125	0.166	0.182	0.16	0.12	0.452	0.145
R4	-0.037	0.028	0.079	0.023	0.027	0.14	0.004
R5	0.205	0.103	0.444	0.176	0.124	0.755	0.196
R6	0.234	0.18	0.231	0.009	0.233	0.66	0.153
WC1	0.276	0.3	0.252	0.233	0.246	0.266	0.635
WC2	0.377	0.344	0.348	0.313	0.275	0.249	0.613
WC3	0.317	0.492	0.328	0.253	0.312	0.066	0.667
WC4	0.13	0.16	0.086	0.157	0.197	0.071	0.311
WC5	0.358	0.509	0.303	0.311	0.425	0.117	0.719
WC6	0.308	0.468	0.395	0.208	0.301	0.269	0.687

### Interpretation of results

A paired sample t-test is a type of statistical analysis used to compare the means of two groups that are conceptually linked or "paired." When there is a connection between two data sets, like when the same group of people is measured before and after an intervention, the test is employed frequently. A statistically significant difference between the two sets of data can be inferred if the mean difference is more than zero. The distribution of the differences between the two data sets is assumed to be normal, and the variances of the two data sets are assumed to be equal, for this test to be valid. The value of t-test is significant in one tail when it is greater than 1.645. From table. 10 it has been seen from results that t-stat of all the factors has greater than 1.645. That's why t-stat is significant among all variables.

**Table 10.**

Variable	X2-X1	Se (X2-X1)	t-stat	P-value
Energy Conservation	2	1.1696	1.7516	0.0000
Water Conservation	2.1	1.1655	1.7826	0.0000
Recycling	2	1.1347	1.7966	0.0000
Environmental Concern	2.2	1.2517	1.7593	0.0000
Health Concern	2.1	1.2126	1.7613	0.0000
Economic Concern	2.3	1.2854	1.7707	0.0000
Environmental Awareness	2.2	1.2549	1.7651	0.0000

After checking the validity and reliability of the data, we interpret the results. A hypothesis will be developed to check the change in behaviors.

$H_0$ : Means are not different.

$H_1$ : The mean of the intervention period is higher than the pre-intervention period.

$H_0: X_2 = X_1$

$X_2 - X_1 = 0$

### Energy Conservation

According to the analyzed data, the change among the post and pre-intervention is 2 and the standard deviation among their means is 1.1696. The value of the paired sample t-test is 1.7516 while the p-value is zero. It has been seen from the data that:

$H_1 : X_2 > X_1$

Since the calculated value of t-statistics is the table value. Therefore, it lies in the critical region. Hence, we reject  $H_0$  and conclude that: On average, energy conservation has increased significantly in the post-intervention period. Therefore, the intervention in energy conservation education reveals to be significant.

### Water Conservation

According to the analyzed data, the change among the post and pre-intervention is 2.1 and the standard deviation among their means is 1.1655. The value of the paired sample t-test is 1.7826 while the p-value is zero. It has been seen from the data that:

$H_1 : X_2 > X_1$

Since the calculated value of t-statistics is the table value. Therefore, it lies in the critical region. Hence, we reject  $H_0$  and conclude that: On average, water conservation has increased significantly in the post-intervention period. Therefore, the intervention in water conservation education reveals to be significant.

### Recycling

According to the analyzed data, the change among the post and pre-intervention is 2 and the standard deviation among their means is 1.347. The value of the paired sample t-test is 1.7966 while the p-value is zero. It has been seen from the data that:

$H_1 : X_2 > X_1$

Since the calculated value of t-statistics is the table value. Therefore, it lies in the critical region. Hence, we reject  $H_0$  and conclude that: On average, recycling has increased significantly in the post-intervention period. Therefore, the intervention in recycling education reveals to be significant.

### Environmental Concern

According to the analyzed data, the change among the post and pre-intervention is 2.2 and the standard deviation among their means is 1.2517. The value of the paired sample t-test is 1.7593 while the p-value is zero. It has been seen from the data that:

$H_1 : X_2 > X_1$

Since the calculated value of t-statistics is the table value. Therefore, it lies in the critical region. Hence, we reject  $H_0$  and conclude that: On average, environmental concern has increased significantly in the post-intervention period. Therefore, the intervention in environmental concern education reveals to be significant.

### Health Concern

According to the analyzed data, the change among the post and pre-intervention is 2.1 and the standard deviation among their means is 1.2126. The value of the paired sample t-test is 1.7613 while the p-value is zero. It has been seen from the data that:

$$H_1 : X_2 > X_1$$

Since the calculated value of t-statistics is the table value. Therefore, it lies in the critical region. Hence, we reject  $H_0$  and conclude that: On average, health concern has increased significantly in the post-intervention period. Therefore, the intervention in health concern education reveals to be significant.

### Economic Concern

According to the analyzed data, the change among the post and pre-intervention is 2.3 and the standard deviation among their means is 1.2854. The value of the paired sample t-test is 1.7707 while the p-value is zero. It has been seen from the data that:

$$H_1 : X_2 > X_1$$

Since the calculated value of t-statistics is the table value. Therefore, it lies in the critical region. Hence, we reject  $H_0$  and conclude that: On average, economic concern has increased significantly in the post-intervention period. Therefore, the intervention in economic concern education reveals to be significant.

### Environmental Awareness

According to the analyzed data, the change among the post and pre-intervention is 2.2 and the standard deviation among their means is 1.2549. The value of the paired sample t-test is 1.7651 while the p-value is zero. It has been seen from the data that:

$$H_1 : X_2 > X_1$$

Since the calculated value of t-statistics is the table value. Therefore, it lies in the critical region. Hence, we reject  $H_0$  and conclude that: On average, environmental awareness has increased significantly in the post-intervention period. Therefore, the intervention in environmental awareness education reveals to be significant.

## DISCUSSION

T-test declare that people learned from seminars and training after the intervention, which changed their behavior compared to pre-intervention data. Climate change's negative effects on people's lives were unknown pre-intervention. Respondents' behavior improved significantly during the 6-month environmental counseling session. They understand climate change now. These simple good actions in daily life will significantly influence your environmental behavior. Energy conservation positively correlates with pro-environmental behavior. Sharpe, Perlaviciute, and Steg (2021) found that energy

saving behavior is positively associated with pro-environmental behavior, suggesting that governments should promote it to increase it. Arya and Chaturvedi (2020) found that energy-saving conduct is positively associated with pro-environmental behavior and suggested that policies that encourage energy-saving behavior may increase environmental behavior. Rosa and Collado (2020) found that energy conservation is positively connected with pro-environmental behavior in both nations and suggested that policymakers promote energy conservation to encourage it. Ng and Cheung (2022) found that social norms can influence pro-environmental behavior and that campaigns that stress the benefits of energy saving to society and the environment can change behavior.

Water conservation positively correlates with pro-environmental behavior. Wang et al. (2022) found that water conservation education increased pro-environmental behavior. Water conservation efforts increased pro-environmental behavior. According to Meuwese, Dijkstra, Maas, and Koole (2021) and Zhang, Wei, Zhu, and George-Ufot (2020) found that social norms modify the water conservation-pro-environmental behavior relationship. The study found that social norms and environmental views influence water conservation behavior (Calabrese, Costa, Gastaldi, Ghiron, & Montalvan, 2021). Stavrianakis (2021) found that Indian households' water conservation habits were positively correlated with pro-environmental behaviors.

The results suggest that recycling promotes environmental behavior. Opuni et al. (2022) observed that regular recyclers were more inclined to conserve water, reduce energy use, and use public transportation. Hua, Dong, and Goodman (2021) discovered that environmentally conscious people with greater recycling social norms were more likely to recycle. Recycling was positively connected with pro-environmental behavior and environmental consciousness among Chinese people (Tilikidou & Delistavrou, 2008).

The study shows that environmental concern strongly influences pro-environmental behavior. Chwialkowska, Bhatti, and Glowik (2020) reviewed 73 publications and discovered a high positive correlation between environmental concern and pro-environmental behavior. Liobikienė and Poškus (2019) discovered that environmental concern positively affects pro-environmental behavior among Chinese inhabitants. Kautish and Sharma (2020) found 104 studies that linked environmental concern to energy conservation, recycling, and eco-friendly consumer choices. According to Soares, Miguel, Venâncio, Lopes, and Oliveira (2021), personal values increase environmental concern and predict pro-environmental conduct. Alzubaidi, Slade, and Dwivedi (2021) found that moral obligation, environmental identity, and self-efficacy mediate the relationship between environmental concern and pro-environmental behavior.

The findings link health concerns to pro-environmental behavior. Martin et al. (2020) found that health concerns were a major predictor of pro-environmental behavior in 69 studies. Fu et al. (2020) found that environmental attitudes influenced the association between health concerns and pro-environmental conduct. Pinzone, Guerci, Lettieri, and Huisingh (2019) found that health and environmental advocates reduced food waste. Yue, Sheng, She, and Xu (2020) found that health concerns positively affected green purchasing behavior and that environmental awareness partially moderated this link.

Pro-environment behavior is strongly connected with economic worry. Geiger, Geiger,



and Wilhelm (2019) found that financially concerned people were more inclined to take environmental action. Salary and job security were strongly connected with pro-environmental behavior (Chwialkowska et al., 2020). Amoah and Addoah (2021) found a positive association between economic concern and environmental opinions and activities, especially among higher-educated people. Kautish and Sharma (2020) found a relationship between pro-environmental behavior and economic concern, but only in environmentalists. Alzubaidi et al. (2021) indicated that English people worried about the economy were more environmentally friendly.

Environmental awareness and pro-environment conduct are positively and significantly correlated. Environmental awareness was positively connected with pro-environmental behavior, mediated by personal standards and perceived behavioral control (Liu, Teng, & Han, 2020). Fu et al. (2020) observed that normative messages and nudges in environmental awareness promoted pro-environmental household water consumption. Environmental awareness partially mediated the positive effect of environmental education on pro-environmental behavior (Amoah & Addoah, 2021). Geiger et al. (2019) found that environmental awareness enhanced sustainable consumption behavior and was partially influenced by environmental views.

## **CONCLUSION**

Climate change is a trending issue these days that affect the whole world badly. It's just because of the wastage of natural resources. That may be in the form of water, energy, plastic, paper and food wastage etc. In this study, we examine a change in the behavior of the IUB employees after an intervention. This research is an experimental study. Data was collected two times in different periods for the same respondents. The population of our research is the teaching staff of The Islamia University of Bahawalpur and the sample size is 150. In April 2022, google forms were shared with the respondents through email. An environment-friendly campaign was started after the 1<sup>st</sup> data collection. Soft posters on water conservation, energy conservation, recycling and environmental awareness were sent to the respondents on a weekly basis. Seminars and sessions were also conducted. Data were collected again in November 2022 after the intervention of 6 months. In this study, we used the aired sample t-tests to measure the change in the pro-environmental behavior of respondents. A strong and significant change is observed among the respondents after the intervention. The result reveals that energy conservation, water conservation, recycling, environmental concern, health concern, economic concern and environmental concern has a positive and significant relationship with pro-environmental behavior.

## **POLICY IMPLICATION**

Individuals should adopt pro-environmental behavior by changing their lifestyle choices. For example, they can conserve energy by turning off lights and unplugging electronics when not in use, reduce waste by recycling and composting, and use eco-friendly products. They should also promote environmental conservation by educating their peers, volunteering for environmental initiatives, and supporting businesses that adopt sustainable practices. They should switch to energy-efficient appliances and devices, use

public transport or carpool, reduce their consumption of meat and dairy, and use renewable energy sources. For water conservation, individuals should take action to conserve water by making small changes in their daily habits, such as taking shorter showers, fixing leaks, and using water-efficient appliances. Educate the individuals about proper recycling practices and encourage their family and friends. Also, use the reusing and repurposing items. There are some limitations while conducting this research. This study just covers the area of The Islamia University of Bahawalpur. Due to the short time, our sample respondents are just teaching staff. Due to the short period the sample size is 150. This kind of study will also conduct on large-scale industries and national levels. In this study we only cover the teaching staff of the university, in future research, there should be the inclusion of the non-teaching staff and students.

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**Consent to Participate:** Yes

**Consent for publication and Ethical approval:** Because this study does not include human or animal data, ethical approval is not required for publication. All authors have given their consent.

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