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Exploring The Potential of Online Media for Climate Change Engagement Among Pakistani Youth: A Study of Multi-Dimensional Relationship of Mediating Variables with Pro-Environment Behavior

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Abstract

Since the start of the 21st century, governments, interest groups, and individuals have increasingly engaged in climate change conservation, recognizing it as a significant threat to the planet, ecosystems, and humanity (Lee et al., 2015). Some countries, like Pakistan, are experiencing severe impacts from climate change, resulting in substantial monetary and humanitarian losses. The Global Climate Risk Report (2021) lists Pakistan among the top ten countries most influenced by climate change. One main solution to addressing climate change is raising green awareness, which can significantly influence citizens and help tackle climate-related issues. In Pakistan, where the ratio of broadband users and 3G/4G subscribers is significantly higher (PTA, 2022), online media is a crucial tool for creating this awareness due to its vast reach and connectivity. Social media holds great potential for raising awareness and promoting civic engagement regarding climate change and its consequences. Cyber-optimists believe that internet platforms can disseminate more knowledge to the public, facilitating productive online civic discussions (Norris, 2001). This study aimed to explore and document the awareness of climate change, related situations, and their consequences among youth. It also investigated the relationship between online engagement and youth awareness of climate change. Using multi-stage sampling, 1,432 university students from the province of Punjab were selected for the study. SEM path analysis in AMOS revealed positive effect of online engagement on pro-environment behavior of youth. Youth's self-perception, beliefs and awareness regarding climate change were identified as the mediating factors, causing a positive association with pro-environment behavior of youth. Results indicated that Pakistani university students are concerned about the country's environmental problems, with air pollution identified as the most severe issue by the majority of respondents. There is also high awareness of the severe health issues caused by climate change. The youth believe that addressing climate change is essential for improving quality of life. While respondents showed pro-environment behaviors in conserving electricity and water, they were less active in recycling. The findings revealed a positive association between online engagement and climate change awareness ($N=1432$, $p<.05$). Similarly, there was a positive correlation between climate change awareness and pro-environment behavior among the youth ($N=1432$, $p<.05$). The recommendations from this study can guide informed policies in both public and private sectors to utilize digital media technologies (DMT's) for active involvement of Pakistani youth. Social media influencers, Vloggers and individuals possessing credibility on digital media platforms can employ these findings to promote pro-environment behavior among youth.

Keywords: Youth pro-environment engagement; online climate change literacy; civic engagement; youth agency in Pakistan; media and democracy; self-perception as pro-environment; pro-environment behavior.

Introduction

Internet is commonly used in Pakistan for various purposes ranging from entertainment to business activities, education, communication and many more. The country has 129 million broadband subscribers and 126 mobile broadband subscribers which amounts to 255 million connections. This vast Internet penetration has the potential to educate the public about various issues faced by Pakistan, one of which is climate change and its devastating effects. Pakistan is amongst the 10 countries on the planet to suffer the most from the ill effects of climate change (USIP, 2022; Global Climate Risk Index Report). Educating the public about this situation is an important step in countering climate change. Pakistani youth who make up for 64% of the Pakistani population, also need climate change awareness, education and involvement. This segment of the population will suffer the longest from the adverse effects of climate change for many years to come. Their involvement with this issue is very important because climate change affects their lives, health and their future. Here online media platforms carry potential to educate this young population, in addition to providing them a space to talk about climate change. Various online platforms give users an opportunity to engage with social, cultural, economic and environmental issues.

Spreading awareness about climate change's impacts is imperative for a country which faces many environmental challenges. Annually the country faces economic losses of more than \$3.8 billion (Climate Risk Country Profiles, 2021). Global EPI (2018) places Pakistan as the 169th country performing poorly and making its population extremely vulnerable to climate change. Climate change impacts jolted the country with the 2022 super floods which submerged one-third of the country under water cost at least \$ 40 billion with scores of people and livestock dead. The updated Pakistani NDC (Nationally Determined Contributions, 2021) report informs that the SDGs 13 (Sustainable Development Goals) which Pakistan must achieve requires climate change action on several fronts. Pakistan must involve its youth through climate education and activism. Pakistan must

form and incorporate climate change coping measures and policies, in addition to building knowledge capacity. Educating the public, and especially youth, about climate change makes them realize the severity and urgency of the situation. Additionally, climate change awareness raises an important alarm that something needs to be done, and done fast. This may influence many to care about this problem, start pondering over it and think of their role to help the environment.

Since the first United Nations climate change summit in Rio de Janeiro in 1992 the importance of awareness in and citizen's involvement in environmental preservation is highlighted in the recent COP27. COP 27 stressed youth inclusion in climate related policies because they will suffer the climate change impacts the longest. Youth education is important because their exposure to environmental calamities are going to be the longest. It is their basic right to know what affects their lives today and for years to come. A powerful speech made by Greta Thunberg in COP 24 (2018) warned the world that climate change is destroying the world with record high emission levels, fast rising temperatures and toxic air pollution. She addressed the conference as the representative of young people and stated that adults have failed the youth around the world and the young people will never forgive the ones who did nothing to control climate change.

The connection of the young generation with climate change impacts has raised alarm regarding the physical and mental health of children and youth. Young people feel anxiety, anger and frustration when they come across information and impacts of climate change. They realize that a secure climate future may be difficult to achieve, and this causes emotional distress. Climate change impacts are not distributed equally around the world, as it has been observed during the last few years that the Global South suffers the brunt of climate change. Therefore, studies analyzing the effects of climate disasters on youth and their coping mechanisms should be coming forth from the countries which make up the Global south.

Sanson and Bellemo (2021) believe that discussion, activism and involvement of youth with climate change problem helps them cope with their anxiety. Ojala (2012) states that children, adolescents and the young who are the real stakeholders in this situation need to be engaged in climate change discussions. Their climate engagement helps in coping and positive youth development. A healthy way of engaging with this problem is described in the Positive Youth Development (PYD) framework by Pereira and Freire (2021). PYD promotes youth involvement, engagement and climate education to counter stress and anxiety. Climate literacy and climate engagement of youth holds promise for the future of democracy. Youth agencies targeted towards climate engagement is not possible without climate literacy which can readily be made available via internet. Dahlgren (2013) believes that youth use of internet and related ICTs not only connects them with the world but also enables them to make sense of their surroundings. For the first time in the history of mankind the Internet and related ICTs are functioning as the habitus of political participation (Dahlgren, 2016).

Generally, information enhances critical thinking and information about climate change enables youth agency geared towards this problem. Youth agency is the beauty of democracy as it enables the future generation to take part in issues which shape their lives. United Nations' International Telecommunication Union (2020) reports that 71% of the youth living around the world are internet-users. Therefore, internet use enabling youth agency for climate engagement means that there exists hope for the future of our planet. Climate awareness through internet also enables youth self-efficacy which may have a positive impact on the environment (Rahim et al., 2022). The main goal here should be to find ways to resolve climate change problem and youth awareness and their pro-environment behavior are important factors in this regard. Climate awareness through internet is fast, cost effective and readily available at the touch of a button.

Literature Review

Since the advent of the new medium – internet, alternative ways of civic and democratic engagements are thriving. Academics hold the view that in today's day and age conventional forms of political engagement have been replaced by issue-based engagement (Bennett, 2007; Norris, 2002a, 2007b). Internet enabled bottom-up communication and horizontal interactions holds hope for the future and sustenance of democracy (Norris, 2001). The Internet has provided new opportunities for active citizenry, pluralistic voices and participation through its various platforms. Additionally, the internet affords mobilization for community affairs inspired by online discussions (Evans-Cowley & Hollander, 2010; Fung, 2015; Naranjo-Zolotov et al., 2019). The health of a community depends on its citizens coming together to engage with issues such as safety, rights of citizens, health issues, environment, infrastructure, facilities and so on. Civic engagement can be defined when citizens engage in political and non-political ways to address community affairs. Civic engagement is attending to matters of public concern through political and non-political ways, in addition to applying collective or individual efforts (Arvanitidis, 2017). Youth civic engagement is also a major driver of community health as youth are the future of any given society. Changes in technology advancements and globalization has rendered a new life to youth's engagement with civic issues (Youniss et. al., 2002). The youth of the 21st century have never lived in a technology-free world not connected by internet devices (Palfrey & Gasser, 2011). Their daily routines and dealing are happening online, instead of in brick-and-mortar institutes. They feel comfortable with the latest technology as they have never lived in a world free of devices.

Young adults felt comfortable with the medium because they have lived in a technological world all their lives, building and maintaining relationships online. Thayer and Ray's (2006) study of 174 participants and their use of internet revealed that young adults spend more time online. The 174 participants were studying using a questionnaire which revealed that gender had no impact on internet usage. Osei Asibey et al. (2017) study of 650 university students from Ghana showed that internet was an important factor in their lives. Their average daily use of the internet ranged from 3 to 7 hours, and they enjoyed ease of use and access of information through this medium. Young people use the internet for connecting with others and forming their self-identities or a sense of themselves (Maczewski, M. (2002). Additionally, youth form informal loose ties while communicating over the internet with like-minded persons (Wellman et al., 2003). This helps them engage with issues which interest them and in turn connects them with social and civic issues (Bennett & Segerberg, 2011; Bennett, 2012).

Media scholars who study the relationship of youth and internet observe that youth enjoy ease of use with internet which makes it their favorite medium (Dahlgren (2013). For any democracy young people hold importance as they are the future of democracy. At the same time it is to be noted that any given democracy does not hold steady for long. According to Dahlgren (2011) the definition of democracy is fluid which changes with social changes and media landscape. Dahlgren further explains that because the internet is embedded in the lives of youth, they conduct their civic agency using online platforms with little to no interest in conventional politics. The best example of this new kind of engagement can be found in Obama's US Presidential campaign in 2008.

The concept of civic engagement being a part of political lives of young adults is discussed by Weiss (2020). Some academics see youth disengaged with politics and others who hold optimistic view represent the youth engaged paradigm. According to this paradigm political engagement is more inclusive as it also represents civic activities, non-political engagement and social movements. According to Weiss (2020) youth prefer to engage in unconventional forms of political engagement such as volunteering and social activities. Similarly, Kamri et al.'s (2019) study discussed youth online involvement with civic relations and informal political participation for issues such as health and rights of individuals. Kamri et al. also presented an inclusive definition for youth politics which takes place making use of online media.

Academics believe that internet platforms provide opportunities to the youth to engage with issues of their choice. According to Maczewski (2002) young people connecting with like-minded individuals online helps them develop their self-identities. Communicating with like-minded persons help also help youth form loose ties online (Wellman et al., 2003). Online loose ties and holding discussions with like-minded individuals about issues of their choice supports psychological well-being and a sense of themselves (Keung & Wai Kit, 2015; Sijabat & Suharti, 2016). The AC-DC Model by Beennett (2007) describes the way young self-actualizing citizen engage with civic issues on their own terms over a medium of their choice with is online media. According to Bennett the youth of today are not interested in conventional politics such as voting, joining a political party and see aged politicians not understanding young peoples' issues. They rather engage in large-scale collective action using online media platforms to address issues of fair trade, minorities' rights and climate change issue. These issues which engage youth on personal level are based on lifestyle values (Bennett & Segerberg, 2011; Bennett, 2012). According to Brügger et al.'s (2020) study of 4000 Swiss youth, climate change concern brought them together online with like-minded persons and these youth held discussions online to resolve climate change.

Citizens' concerns and information exposure about CC gives fuel to green politics which is based in participatory and deliberative democracy (Peters, 2019). According to Hestres and Hopke (2017) online CC conversations and news stories about CC are increasingly becoming common as compared to political and economic news. Schäfer and Schlichting's (2014) meta-analysis showed that CC news stories started appearing in the 1990s but rose considerably after the advent of internet in the 2000s. Online social movements such as green politics means good for the health of democracy as it involves the youth with civic issues (Pickering et al., 2020). Citizens' networking due to the new media has given rise to the new kind of engagement which Dahlgren (2004) calls 'lifestyle politics'. Contemporary public spheres that can function due to the new media have enabled youth to engage in lifestyle politics such as the CC issue.

Internet offers engagement regarding the CC issue through its many platforms. Firstly, internet as an informant and secondly, allows the user to search CC issue, discuss with like-minded persons and share CC information with peers. The audio-visual characteristic of internet makes it attractive for users and allows them ease of engagement with social issues including CC issue (Hestres and Hopke's 2017). The role internet in the lives of youth holds importance as it provides a window for them to understand the world through online platforms. In Kim and Yang's (2016) study of Korean youth this role of contemporary online platforms was studied with regards to youth civic engagement. Kim and Yang describe alternative forms of social and political participation by Korean youth through online platforms which made them feel empowered. Similarly, Mertens and Hobbs (2015) study of American youth saw an association of media skills, media literacy and frequency of use with youth civic engagement. They also found that youth's intentions towards civic activities and their motivation to gather information made them use online platforms more for civic engagement. The role of online platforms is increasingly becoming central to the political lives of the youth, providing digital engagement spaces for participatory politics (Kahne & Bowyer, 2019). CC information and digital engagement by youth making use online platforms is an important part of youth participatory politics. Arlt et al.'s (2018) study found that German citizens were coming across online information about CC in addition to actively seeking CC information through various social networks.

Methodology

The Study used a scientific design in order to measure the association between the online media and online engagement regarding Climate Change among Pakistani youth. Role of Online media platforms, namely, Google, Facebook, Twitter WhatsApp, YouTube, and Instagram in terms of Information dissemination and online engagement of youth regarding CC was analyzed. Objectives of research required quantitative methodology. The survey method was used as the tool of data collection and for this purpose, a questionnaire was developed.

Population and universe: After literature review Youth was identified heterogeneous in nature; a population comprised of diverse groups and each group possessing distinctive characteristics/each was found to possess distinctive characteristics. This diversity was also reflected in their beliefs on environment of Pakistan, Climate Change (CC) and their expected role to combat these issues were highlighted. This variance was expected to explore interesting yet significant findings. Universities are the most appropriate source of accessing target audience of the study in hand because students with diversified backgrounds get enrolled in them. The province of Punjab has many educational institutes; thus, University students of this province were designated as the population of study.

Sample: Multi-stage sampling technique was used to collect data from students enrolled from Intermediate to PhD level with an age bracket of 15 years of age.

Mediation analysis: This study used Mediation analysis to explore the role of mediating variables i.e climate change awareness, self-perception and beliefs work as mediating variables in transmitting/ transmit the effects of the online engagement on the behavior. From among mediation analysis researchers can choose from multiple regression and SEM (Structural Equation Model) path analysis. The present study employed SEM in the initial stage of data analysis. Due to its ability to manipulate and make use of the data extracted from SPSS the researchers used AMOS software.

Results and Discussion

To investigate internet's role in helping engage the Pakistani youth with climate change and its adverse effects for Pakistan, survey method was employed with the questionnaire based on 5 scales. Data was collected from 1432 university students of the province of Punjab, Pakistan, aged 15-30 years of age. The young respondents had to provide information for the 5 scales of the questionnaire which are discussed subsequently.

Scale 1- Climate Change Awareness Scale: In the first scale of the questionnaire young respondents were asked to indicate their knowledge about various CC problems. A majority (83%) indicated that air pollution was the biggest CC problem faced by the country and 62% said that bad air affected their health and the health of their families. Respondents' concern for air pollution is due to the fact that quality of air in Pakistan never reaches a healthy AQI level with the big cities getting blanketed by smog during the winter months. World Bank (2019) declares that in Pakistan PM 10 is among the highest in the world, even exceeding PM 10 levels of china and India. Moreover, a 2015 study in Lancet reports that more than 300,000 deaths annually in Pakistan occur due to air pollution (Amnesty International, 2019).

Retorting to other queries more than 65% of the respondents indicated that plastic waste, deforestation, vehicular pollution, water and industrial pollution were severe problems faced by Pakistan. More than 50% of the respondents believe that noise pollution, food insecurity, floods, droughts, melting glaciers and rise in temperature were dangerous for Pakistan. Respondents' awareness for air pollution and its adverse effects is present, but awareness about other CC issues of Pakistan seems to be lacking although Pakistan environmental performance on all fronts is extremely poor. According to Global EPI (2022), Pakistan ranks 176 out of the 180 countries ranked for environmental performance.

Scale 2 - Pro-Environment Belief Scale: This scale contains self-developed units in addition to units taken from the ISSP 2010 – Environment III Basic Questionnaire (2011) and the Malaysian public awareness study (Chin et al., 2019). Answering the questions 85% of the respondents believe that CC is causing health problems and 15% respondents either reply in negative or are unsure. When asked if environmental protection is necessary for better quality of life 82% reply with 'yes' and 17% with 'no' and 'maybe'. Similarly, 82% also reply that a better world is possible with environmental protection. More than 50% indicate that they believe that they know about causes and solution to CC issues.

Scale 3- Self-Perception Scale: CC awareness is a strong predictor of pro-environment lifestyle, but a person's identity as being eco-friendly is also very important. Self-efficacy, identifying as a person who cares for nature preservation, avoids habits that harm the planet and believes that he/she can act in ways to help the environment are all important factors. To test these elements Self-Perception Scale asked young respondents about how they feel about the environment around them and their role. 74 % felt that they had a moral obligation to environmental protection and 67 % indicated that they worry about CC. Additionally, Self-Perception Scale inquired about the role of internet in assisting respondents in addressing their concern for CC. Consequently, 72% said they feel a moral obligation to share CC issues on online platforms. 68% indicated that sharing and commenting online about CC issues made them feel like a part of society. 65% said that such online activities made them feel that they are able to influence public opinion. More than 60% indicated that by sharing and commenting in this manner make them feel like a responsible citizen, committed to the CC cause, and having a voice that matters in the society. This feeling of commitment to the CC cause that the connection young respondents feel with their surroundings is a positive indication that civic engagement is thriving with the young respondents. The belief that their voice matters for others gives them a confidence as a citizen. Their agency (thoughts and actions) have to potential of them pro-environment once they feel a moral obligation towards CC cause.

Scale 4 - Online Engagement Scale: Internet technology and related ICTs are the choice of medium for many when it comes to CC information (Devkota & Phuyal, 2017). As far as the present study is concerned more than half of the respondents (55%) indicate that online media platforms are the most effective and their preferred medium when it comes to CC information. This is followed by TV preferred by 32%, magazines preferred by 8%, and a few respondents preferring books, movies and radio. 60% indicate that they come across CC information through Google, 51% have come across CC related YouTube videos, 56% have seen feeds about CC on Facebook and 62% have seen such feeds on Instagram. When it comes to sharing and commenting on online platforms, 56% say they share and comment on CC related Insta reels and 47% on Facebook. 48% share CC related content on WhatsApp, 38% share and comment on YouTube videos, and only 31% indicate that they use Twitter/X for CC content. Instagram seems to be most favored by young respondents with Twitter/X being least used by them.

Scale 5 - Pro-Environment Behavior Scale: In addition to self-developed units related to local habits and behavior of Pakistanis, questionnaire units were also taken from studies Pato et al. (2005), Díaz et al. (2007), Ojala and Bengtsson (2019) and Bronfman et al. (2015). Several academic works specify that eco-friendly thinking and lifestyle is influenced by family and friends (Van Zee et al., 2022; Gong et al., 2021; Iwaniec & Curdt-Christiansen, 2020; Stevenson et al., 2019; Ojala & Bengtsson, 2019; Valdez et al., 2018). Here in this study more than 70% respondents indicate that they discuss environmental problems and try to influence their family and friends to lead eco-friendly lives. Around 25% to 30% reply to such behavior with a 'no'

or 'maybe'. More than 80% of the respondents say 'yes' when asked if they are careful with water usage and saving electricity. More than 50% say 'yes' to recycling paper, glass, cans and use of cloth bags. More than 60% say 'yes' they have planted trees around their homes and other places. About 40% indicated that they avoid using environmentally hazardous products, which can also mean that there is lack of awareness about such products.

Statistical Analysis: The 5 scales present in the questionnaire provide data to be tested statistically in AMOS, explain various associations and effects that variables have in this data. For data analysis SEM (Structural Equation Model) path analysis was used so data can be presented graphically, showing path coefficients, direct and indirect effects. 6 hypotheses were tested through path analysis which tested relation between dependent variable namely pro-environment behavior and the independent variable of online engagement hypotheses testing by SEM path analysis also showed the effects of mediating variables, which are CC awareness, beliefs and self-perception. Due to a large data volume and different number of units present in the 5 scales the technique of item parceling was employed by running exploratory factor analysis. EFA condensed data for better interpretation and is presented in the table below:

Table 1: Exploratory Factor Analysis

Variables	Factor 1	Factor 2	Factor 3
Factors for Climate Change Awareness	CA-3	CA-6	CA-1
	CA-5	CA-11	CA-2
	CA-7	CA-12	CA-4
	CA-8	CA-13	
	CA-9	CA-14	
	CA-10	CA-15	
Factors for Pro-Environment Belief		CA-16	
	Belief-3	Belief-4	Belief-1
	Belief-5	Belief-6	Belief-2
	Belief-7	Belief-8	
Factors for Pro-Environment Behavior		Belief-9	
	Beh-10	Beh-1	Beh-3
	Beh-11	Beh-2	Beh-4
	Beh-12	Beh-6	Beh-5
	Beh-13	Beh-7	
	Beh-14	Beh-8	
Factors for Pro-Environment Online Engagement	Beh-15	Beh-9	
		Beh-16	
	OE-4	OE-3	OE-1
	OE-9	OE-5	OE-2
	OE-10	OE-6	
	OE-11	OE-7	
	OE-12	OE-8	

Note. EFA was applied to each factor, Principal Component Analysis was done as the extraction method and Varimax with Kaiser Normalization was the rotation method.

After running EFA, condensed data was ready to test the associations through SEM path analysis. The following model took shape:

Figure 1: SEM Path Analysis presenting associations between online engagement and behavior, along with paths between moderating variables of CC awareness, self-perception, and beliefs.

Note. Online engagement affecting behavior makes up the focal relationship which is being affected by the mediating factors of awareness, beliefs, and self-perception. In the above presented path analysis independent factor or online engagement is directly affecting environmental behavior, denoted by c' . Additionally, mediating factors, which are awareness for CC, self-perception, and beliefs of respondents, are being affected by the independent factor. Online engagement's affect on CC awareness is denoted by $a1$, $a2$ denotes online engagement's affect on self-perception and online engagement's affect on pro-environment behavior is denoted by $a3$. CC awareness' affect on self-perception is denoted by $d21$, awareness' affect on beliefs is denoted by $d31$ and on behavior by $b1$. Self-perception's affect on behavior is denoted by $b2$ and beliefs' affect on behavior is denoted by $b3$. Awareness' affect on beliefs is denoted by $d31$ and affect of awareness on self-perception is denoted by $d32$. LV- SEM (latent variable structural equation modelling) presented an excellent fit to data because the Chi-square value of 9.225 (p -value=0.056) was insignificant showing an ideal model to fit. Values of Model Fit are presented below:

Table 2: Goodness of Fit Indices

Model	Absolute Fit Measure					
	CMIN	CMIN/df	GFI	AGFI	SRMR	RMSEA
Adequate Fit	---	< 5	> 0.90	> 0.90	<0.08	< 0.08 or 0.05
Index Value	9.225	2.306	0.998	0.989	0.0182	0.030
Comment	---	Achieved	Achieved	Achieved	Achieved	Achieved
Model	Incremental Fit Measure					
	NFI	CFI	TLI	IFI		
Adequate Fit	> 0.90	> 0.90	> 0.90	> 0.90		
Index Value	0.992	0.995	0.983	0.996		
Comment	Achieved	Achieved	Achieved	Achieved		

Note. CMIN = Chi-square statistics; CMIN/df = minimum discrepancy function by degrees of freedom divided; GFI = goodness of fit index; AGFI= adjusted goodness of fit index; SRMR = standardized root means square residual; RMSEA= root mean square error of approximation; NFI = incremental measure of goodness of fit; CFI= comparative normed fit index; TLI= Tucker-Lewis index; IFI= incremental fit index.

SEM path estimates for the 6 hypotheses of the present study are presented below:

Table 3: Parameters Estimates

Path from	To	Parameter Estimate	SE	t-value
Online Engagement	Awareness about CC	0.040*	0.017	2.209
Awareness about CC	Self-Perception	0.199*	0.038	5.308
Self-perception	Belief	0.275*	0.018	14.8461
Belief	Behavior	0.316*	0.0204	15.437
Online Engagement	Behavior	0.112*	0.014	8.299

Note. * = significant result at 5% level of significance

Hypotheses

H1 - There is a positive association between pro-environment online engagement and climate change awareness of youth.

Model 1.

$$\text{Climate Chnage Awareness} = a + b \text{ Online Enagagment}$$

$$\text{Climate Chnage Awareness} = 1.679 + 0.040 \text{ Online Enagagment}$$

Table 4: Model summary for positive affect of online engagement on CC awareness

Model Summary	R	R-sq	MSE	F	Dfl	df2	P
CC_AWR	.0736	.0054	.1196	3.8874	2.0000	1429.0000	.0207
Model	Coeff	Se	T	P	LLCI	ULCI	
Constant	1.7230	.0477	36.1072	.0000	1.6294	1.8166	
OE	.0388	.0168	2.3098	.0210	.0059	.0718	
Gender_1	-.0260	.0186	-1.4022	.1611	-.0624	.0104	

Note. CC_AWR = awareness for CC; OE = online engagement; R = Correlation coefficient; R-sq = model fit; MSE = mean squared error; F = Fisher-Snedecor distribution; dfl = number of treatment levels-1; df2 = number of observations-number of groups; p = probability; coeff = correlation coefficient; se = standard error; t = test statistics; LLCI = lower limit confidence interval; ULCI = upper limit confidence interval.

After running simple regression H1 presents a positive relationship between pro-environment online engagement and CC awareness among youth was predicted. Table shows a positive path estimate (0.040, $p < 0.05$) from online engagement to CC awareness is present, thus H1 is supported.

H2 - There is a positive association between awareness about climate change and youth's self-perception as pro-environment citizens.

H2 predicts a positive association between CC awareness and self-perception as pro-environment citizens. Multiple regression was run for testing H2 which presented a parameter estimate of 0.1998, with p-value < 0.05 indicating a significant affect, therefore, H2 was accepted and the following possible model took shape:

Model 2.

$$\text{Self Preception} = a + b_1 \text{ Online Enagagment} + b_2 \text{ Climate Change Awarness}$$

$$\text{Self Preception} = 0.760 + 0.1980 \text{ Online Enagagment} + 0.199 \text{ Climate Change Awarness}$$

Table 5: Model summary for positive affect of the independent variable online engagement and mediating factor CC awareness onto self-perception as pro-environment citizens.

Model Summary SP	R	R-sq	MSE	F	Dfl	df2	P
	.2598	.0675	.2422	34.4671	3.0000	1428.0000	.0000
Model		Coeff	Se	T	P	LLCI	ULCI
Constant		.7201	.0939	7.6692	.0000	.5359	.9042
OE		.1997	.0240	8.3332	.0000	.1527	.2467
CC_AWR		.1998	.0376	5.3082	.0000	.1260	.2736
Gender_1		.0220	.0264	.8339	.4045	-.0298	.0739

Note. SP = self-perception as responsible citizens; CC_AWR = awareness for CC; OE = online engagement.

H3: There is a positive association between youth's self-perception and their pro-environment beliefs.

Multiple regression was carried out to see the effect of independent factor (online engagement) and two mediating factors (CC awareness and self-perception) on the third mediating factor of beliefs of youth regarding CC. For H3 parameter estimate value of 0.275 with p-value of 0.00 shows a significant effect of the three factors onto the belief factor. This positive association is presented below in Model 3 and Table.

Model 3.

$$\text{Belief} = a + b_1 \text{ Online Enagagment} + b_2 \text{ Climate Change Awarness} + b_3 \text{ Self Preception}$$

$$\text{Belief} = 0.445 + 0.116 \text{ Online Enagagment} + 0.191 \text{ Climate Change Awarness} + 0.275 \text{ Self Preception}$$

Table 6: Model summary for positive affect of online engagement, CC awareness and self-perception onto the beliefs of respondents.

Model Summary BELIEF	R	R-sq	MSE	F	Dfl	df2	P
	.4789	.2294	.1184	106.1758	4.0000	1427.0000	.0000
Model		Coeff	Se	T	p	LLCI	ULCI
Constant		.4456	.0670	6.6519	.0000	.3142	.5770
OE		.1162	.0172	6.7694	.0000	.0825	.1498
CC_AWR		.1909	.0266	7.1814	.0000	.1387	.2430
SP		.2747	.0185	14.8461	.0000	.2384	.3110
Gender_1		-.0001	.0185	-.0051	.9960	-.0363	.0362

Note. BELIEF = beliefs of youth about CC; SP = self-perception as responsible citizens; CC_AWR = awareness for CC; OE = online engagement.

H4: There is a positive association between pro-environment beliefs and pro-environment behavior of youth.

Multiple regression was run with one independent variable (online engagement), three mediating factors (CC awareness, self-perception, beliefs) and the dependent factor (behavior of youth) for H4. A significant p-value (0.00) and parameter estimate of 0.315, association between beliefs and behavior of youth was found. Thus, H4 was accepted and association is presented below in Model 4 and Table.

Model 4.

$$\text{Behavior} = a + b_1 \text{ Online Enagagment} + b_2 \text{ Climate Change Awarness} + b_3 \text{ Self Preception} + b_4 \text{ Belief}$$

$$\text{Behavior} = 0.504 + 0.112 \text{ Online Enagagment} + 0.035 \text{ Climate Change Awarness} + 0.171 \text{ Self Preception} + 0.316 \text{ Belief}$$

Table 7: Model summary for positive affect of online engagement, CC awareness and self-perception and beliefs onto the pro-environment behavior of respondents.

Model Summary BEH	R	R-sq	MSE	F	Df1	df2	P
	.6153	.3787	.0706	173.8008	5.0000	1426.0000	.0000
Model	Coeff	se	T	p	LLCI	ULCI	
Constant	.4680	.0525	8.9104	.0000	.3650	.5710	
OE	.1117	.0135	8.2994	.0000	.0853	.1381	
CC_AWR	.0357	.0209	1.7108	.0873	-.0052	.0767	
SP	.1708	.0154	11.1238	.0000	.1407	.2009	
BELIEF	.3155	.0204	15.4367	.0000	.2754	.3556	
Gender_1	.0203	.0143	1.4258	.1541	-.0076	.0483	

Note. BEH = dependent factor/ pro-environment behavior of youth; OE = independent factor/ online engagement; CC_AWR = mediating factor; SP = mediating factor; BELIEF = mediating factor.

H₅: There is a positive association between pro-environment online engagement and pro-environment behavior of youth.

SEM model presents a strong positive path estimate from online engagement to behavior (0.112, <0.05), thus, H₅ was supported. These are presented graphically in the Figure below and Table.

H₆: Awareness of climate change, self-perception and beliefs of youth sequentially mediate the relationship between pro-environment online engagement and behavior of youth.

SEM analysis presented a direct effect and indirect effects. Direct effect existed between online engagement and pro-environment behavior of youth. Indirect effects of online engagement, awareness, self-perception and beliefs affect pro-environment behavior. H₆ presents a crux of all the relations discussed above in addition to showing the focal relation and mediating variables of the present study. These relations are presented below in Figure which shows direct and indirect effects between the independent factor (online engagement), dependent factor (behavior) and mediating factors (awareness, self-perception, beliefs).

Figure 2: Sequential Model Mediation Analysis

Note. Direct effect exists between online engagement and pro-environment behavior. Indirect effect for a sequential mediation can be obtained by multiplying respective paths.

Table 8: Indirect Effect Key for sequential mediator analysis with 3 Mediators

Indirect Effect 1	Online Engagement → Climate Change Awareness → Behaviour
Indirect Effect 2	Online Engagement → Self Perception → Behavior
Indirect Effect 3	Online Engagement → Belief → Behavior
Indirect Effect 4	Online Engagement → Climate Change Awareness → Self Perception → Behavior
Indirect Effect 5	Online Engagement → Climate Change Awareness → Belief → Behaviour
Indirect Effect 6	Online Engagement → Self Perception → Belief → Behavior
Indirect Effect 7	Online Engagement → Climate Change Awareness → Self Perception → Belief → Behavior

Note. Indirect Effect of X on Y through $M_i = a_i b_i$

Indirect Effect of X on Y through $M_1 = a_1 b_1 = (0.040 * 0.035) = 0.0014$

Indirect Effect of X on Y through $M_2 = a_2 b_2 = (0.198) * (0.171) = 0.0340$

Indirect Effect of X on Y through $M_3 = a_3 b_3 = (0.116 * 0.316) = 0.0367$

Indirect Effect of X on Y through $M_1 \& M_2 = a_1 d_{21} b_2 = (0.040) * (0.199) * (0.171) = 0.00136$

Indirect Effect of X on Y through $M_1 \& M_3 = a_1 d_{31} b_3 = (0.040) * (0.191) * (0.316) = 0.0024$

Indirect Effect of X on Y through $M_2 \& M_3 = a_2 d_{32} b_3 = (0.198) * (0.275) * (0.316) = 0.0173$

Indirect Effect of X on Y through $M_1, M_2 \& M_3 = a_1 d_{21} d_{32} b_3 = (0.040) * (0.199) * (0.275) * (0.316) = 0.0007$

Sum of all indirect effects = 0.0938

Direct Effect of X on Y = $c' = 0.112$

Total Effects of X on Y = $0.0938 + 0.110 = 0.204$

Table 9: Direct, indirect, and total effects

Effect	Coefficients	SE	T value
Indirect Effect	0.0938	0.0097	
Direct Effect	0.112*	0.0135	8.299
Total Effect	0.206*	0.0154	13.313

Note. * = significant result at 5% level of significance; direct effect (0.112, $p < 0.05$) and total effect (0.206, $p < 0.05$) were positively significant.

Conclusion

Youth issue-based civic engagement being facilitated by online media is addressed in the present study. Data from 1432 university students of Punjab, Pakistan shows that respondents care about the climate change issue of Pakistan. They show concern for the matter and make use of online platforms to engage with CC issues. The 6 hypotheses of the present study tested by LV-SEM path analysis indicate that the youth of Pakistan get awareness about CC, have pro-environment self-perception and beliefs. LV-SEM analysis also shows online media has a positive effect on the pro-environment behavior of youth. The present study is a contribution to the literature of participatory democracy, deliberative democracy, citizen participation and media and democracy.

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