

COGNITIVE DISSONANCE AS A MEDIATOR OF CLIMATE CHANGE ATTITUDE: THE MODERATING ROLE OF ENVIRONMENTAL KNOWLEDGE

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ABSTRACT

Pakistan is consistently ranked among the countries most vulnerable to climate change, yet public attitudes toward climate change remain inconsistent and, at times, resistant to change. Grounded in cognitive dissonance theory, this study examined cognitive dissonance as a mediator of the relationship between climate change discourse exposure on social media and climate change attitudes, and tested environmental knowledge as a moderator of this process. Using a cross-sectional survey design, data were collected from 256 Pakistani university students aged 19–26, yielding a final clean sample of 250 after excluding invalid responses. Data were analyzed using SPSS and the Hayes PROCESS macro to test a moderated mediation model. Results showed that discourse exposure was positively associated with cognitive dissonance ($b = 0.43$, $p < .001$), which in turn significantly predicted climate change attitudes ($b = 0.29$, $p < .001$), supporting a significant indirect effect ($ab = 0.13$, 95% CI [0.08, 0.20]). Environmental knowledge significantly moderated this mediating pathway (index of moderated mediation = -0.06 , 95% CI [-0.11, -0.02]): the indirect effect of discourse exposure on attitudes through dissonance was strongest among students with low environmental knowledge and weakest among those with high environmental knowledge. These findings extend cognitive dissonance theory into a social-media-exposure context within a developing country and suggest that environmental knowledge may buffer attitudes from being driven primarily by the discomfort of conflicting information. Implications for climate communication and environmental education among Pakistani youth are discussed.

I. INTRODUCTION

Climate change remains one of the most pressing global challenges, with developing countries bearing a disproportionate share of its consequences despite contributing minimally to its causes. Pakistan has consistently

ranked among the countries most severely affected by climate-related extreme weather events over the past two decades, according to Germanwatch's Global Climate Risk Index (Eckstein et al., 2021). Public attitudes toward climate change play a central role in shaping mitigation and adaptation efforts, since sustained behavioral and policy change depends heavily on how seriously the public perceives the threat. Yet despite Pakistan's well-documented exposure to climate risk, awareness does not always translate into supportive attitudes or consistent engagement, a paradox that calls for closer psychological examination. This paradox is not unique to Pakistan. Across contexts, individuals frequently recognize climate change as a legitimate threat yet continue to behave inconsistently, a pattern long documented as the attitude–behavior gap (Kollmuss & Agyeman, 2002). Motivated reasoning further complicates this picture: exposure to climate messaging can sometimes deepen resistance rather than resolve it, particularly when the message conflicts with a person's identity or worldview (Hart & Nisbet, 2012). Similarly, individuals motivated to defend existing social and economic systems tend to deny or minimize environmental threats rather than accommodate them (Feygina et al., 2010). These patterns point toward a shared underlying mechanism: the discomfort produced when new information conflicts with existing beliefs or behavior — best explained through cognitive dissonance.

Cognitive dissonance theory, originally proposed by Festinger (1957), posits that individuals experience psychological discomfort when they hold cognitions that are inconsistent with one another, and are motivated to reduce that inconsistency. In climate contexts, dissonance can be operationalized as the discomfort, unease, and internal conflict that arise when individuals encounter information contradicting their existing beliefs (Elliot & Devine, 1994). Because climate action often demands costly or identity-threatening change, dissonance provides a compelling framework for understanding why attitudes remain inconsistent even amid clear evidence (Festinger, 1957). Social media has become a dominant channel through which individuals encounter climate information, exposing users to both scientific content and misinformation, often within the same feed (Treen et al., 2020). Discourse on these platforms tends to cluster into echo chambers that reinforce existing views (Williams et al., 2015), and discussion volume spikes sharply around extreme weather events (Roxburgh et al., 2019). In Pakistan specifically, a nationwide survey following the 2022 floods found social media and WhatsApp were the leading sources of climate information (Irfan et al., 2024). Repeated exposure to conflicting narratives increases the likelihood of encountering information that clashes with prior beliefs, triggering the conditions under which dissonance arises (Elliot & Devine, 1994).

A growing body of research links cognitive dissonance to climate denial, defensive processing, and selective engagement. Recent work reframes climate denial not as insufficient knowledge but as identity protection, where individuals reinterpret or reject threatening information to resolve discomfort (Ebrahimi, 2025). Most of this evidence, however, originates from Western, developed-country contexts, leaving open how dissonance operates among populations facing direct climate risk, such as Pakistani university students. Environmental knowledge is commonly distinguished into objective knowledge (factual understanding) and subjective knowledge (self-perceived understanding), which do not always align or predict outcomes similarly (Geiger et al., 2019). A cross-national study of university students found greater climate knowledge associated with more favorable attitudes and reduced psychological distress (Abousoliman et al., 2024), suggesting knowledge can help resolve conflict. Yet individuals with greater knowledge may also more readily recognize inconsistencies, paradoxically heightening sensitivity to conflicting information rather than resolving it (Geiger et al., 2019).

University students are a particularly relevant population here — frequent social media users positioned to become future climate decision-makers. Evidence suggests awareness is present but inconsistent among Pakistani students; a study across Multan universities found student awareness notably lower than faculty awareness (Natalia et al., 2023). Despite this gap, little research examines the psychological mechanisms underlying how Pakistani students process climate information online. Taken together, discourse exposure, cognitive dissonance, environmental knowledge, and climate attitudes have largely been examined in isolation. No known study has tested whether cognitive dissonance mediates the relationship between social media climate discourse exposure and climate change attitudes, while environmental knowledge moderates this relationship, among Pakistani university students. The present study addresses this gap, examining cognitive dissonance as mediator and environmental knowledge as moderator using a cross-sectional design with Pakistani university students aged 19–26, operationalizing discourse exposure in line with prior social media research (Treen et al., 2020). This study

offers three contributions. Theoretically, it extends cognitive dissonance theory (Festinger, 1957) into a moderated-mediation framework. Practically, findings may inform climate communication by narrowing the attitude–behavior gap (Kollmuss & Agyeman, 2002). Contextually, it provides evidence from a climate-vulnerable country (Eckstein et al., 2021) with limited psychological research in this area. Based on this rationale, the study tests the following hypotheses:

1. Climate change discourse exposure on social media is positively associated with cognitive dissonance.
2. Cognitive dissonance mediates the relationship between climate change discourse exposure and climate change attitudes.
3. Environmental knowledge moderates the relationship between cognitive dissonance and climate change attitudes, such that the relationship is weaker at higher levels of environmental knowledge.

II. METHOD

Participants

This study employed a cross-sectional survey design to examine cognitive dissonance as a mediator between exposure to climate change discourse and climate change attitudes, with environmental knowledge as a moderator. The design was selected for its practicality in capturing relationships among these variables at a single point in time and is consistent with prior applications of cognitive dissonance theory (Festinger, 1957) in attitude research. The study was conducted independently, without institutional affiliation or external funding. Participants were university students in Pakistan aged 19 to 26 years. A convenience sampling technique was used, with recruitment conducted through student-oriented social media groups, university-adjacent online communities, and academic forums. Based on power considerations for moderated mediation models (medium effect size, $\alpha = .05$, power = .80), a minimum target sample of 200–250 respondents was set. A total of 256 responses were collected, of which 6 were excluded due to invalid response patterns, including uniform response sets across all items, incomplete submissions, and duplicate selections on single items, yielding a final clean sample of $N = 250$.

Inclusion criteria *includes* 1) Enrolled as a university student (undergraduate or graduate) in Pakistan at the time of participation, 2) Aged between 19 and 26 years, 3) Completed at least one full academic year of study, 4) Active user of at least one social media platform, and 5) Provided informed consent to participate. The exclusion criteria, 1) Students in their first semester of enrolment (insufficient exposure period to climate discourse), 2) Individuals outside the specified age range, 3) Incomplete survey responses (less than 90% of items answered), and 4) Non-students or individuals unable to confirm current university enrolment.

Measures

[1] Climate change discourse exposure was assessed using an adapted media exposure scale capturing frequency of engagement with climate-related content across social media platforms, with particular attention to exposure to conflicting information. **[2]** Cognitive dissonance was measured using Elliot and Devine's (1994) three-item discomfort scale (uncomfortable, bothered, uneasy). **[3]** Climate change attitudes were assessed across belief, concern, and behavioral intention, adapted from measures previously used with Pakistani university samples. **[4]** Environmental knowledge was measured using both a subjective self-report item and an objective knowledge test. All scales were pilot-tested across two rounds of face-validity checking ($N = 8$, then $N = 5$) prior to full deployment, with item wording revised based on participant feedback.

Procedure

Data were collected through an anonymous, self-administered online questionnaire distributed via social media and student communities. As an independent, non-institutionally affiliated study, formal ethics board review was not applicable; however, standard ethical safeguards were followed. Participants were informed of the study's purpose and voluntary nature, and electronic informed consent was obtained prior to survey access. The study posed minimal risk, involving no deception or sensitive disclosures, and no identifying information was collected. Data were analysed using SPSS. Descriptive statistics, reliability analysis (Cronbach's alpha), and correlation analysis were conducted prior to hypothesis testing. The Hayes PROCESS macro (Model 7) was used to test the moderated mediation model, with 5,000 bootstrap resamples and 95% bias-corrected confidence intervals to

evaluate direct, indirect, and conditional indirect effects. As this research was conducted independently without institutional funding or affiliation, no formal ethics board approval applies. However, the study adhered to core ethical research principles, including informed consent, voluntary participation, anonymity, and data confidentiality, consistent with standard practices for social science research involving human participants.

III.RESULTS

Table I: Demographic Characteristics of Respondents (N = 250)

Variable	Category	n	%
Age	19–21	105	42.0
	22–24	98	39.2
	25–26	47	18.8
Gender	Male	118	47.2
	Female	132	52.8
Education	Undergraduate	180	72.0
	Graduate	70	28.0

Data were collected from 256 respondents, of whom 6 were excluded due to invalid response patterns, yielding a final clean sample of N = 250. Demographic characteristics of the sample are presented in Table 1.

Table II: Descriptive Statistics and Correlation Matrix

Variables	M	SD	1	2	3	4
1. Climate Change Exposure	3.54	0.76	—			
2. Cognitive Dissonance	2.97	0.81	.41**	—		
3. Climate Change Attitudes	4.08	0.63	.48**	.36**	—	
4. Environmental Knowledge	3.72	0.69	.39**	.24**	.52**	—

Note. ** $p < .01$.

Descriptive statistics and zero-order correlations among study variables are presented in Table 2. All study variables were positively and significantly correlated ($p < .01$).

Table III: Reliability Statistics

Scales	Items	Cronbach's α
Climate Change Exposure	5	.84
Cognitive Dissonance	3	.87
Climate Change Attitudes	6	.90
Environmental Knowledge	1	.78

Reliability analysis indicated acceptable to excellent internal consistency across all scales (Table 3).

Table IV: Direct and Total Effects

Path	b	SE	T	p	95% CI
Exposure → Dissonance	0.43	0.06	7.17	<.001	[.31, .55]
Dissonance → Attitudes	0.29	0.05	5.80	<.001	[.19, .39]
Total Effect	0.52	0.07	7.43	<.001	[.38, .66]
Direct Effect	0.39	0.06	6.32	<.001	[.27, .51]

Direct and total effects are presented in Table 4. Climate change discourse exposure was positively associated with cognitive dissonance ($b = 0.43$, $SE = 0.06$, $t = 7.17$, $p < .001$), and cognitive dissonance significantly predicted climate change attitudes ($b = 0.29$, $SE = 0.05$, $t = 5.80$, $p < .001$). The total effect of discourse exposure on attitudes was significant ($b = 0.52$, $SE = 0.07$, $t = 7.43$, $p < .001$), as was the direct effect after accounting for the mediator ($b = 0.39$, $SE = 0.06$, $t = 6.32$, $p < .001$).

Table V: Mediation Analysis: Indirect Effect

Effect	Boot Estimate	Boot SE	LLCI	ULCI
Indirect Effect ($a \times b$)	0.13	0.03	0.08	0.20

As shown in Table 5, the indirect effect of discourse exposure on attitudes through cognitive dissonance was significant ($ab = 0.13$, $SE = 0.03$, 95% CI [0.08, 0.20]), as the bootstrap confidence interval did not cross zero, supporting cognitive dissonance as a mediator (H1 and H2 supported).

Table VI: Moderation Analysis: Interaction Effect

Predictor	b	SE	T	p	ΔR^2
Cognitive Dissonance	0.28	0.05	5.60	<.001	—
Environmental Knowledge	0.31	0.05	6.21	<.001	—
Interaction	-0.14	0.04	-3.41	.001	.03

Moderation analysis (Table 6) revealed a significant interaction between cognitive dissonance and environmental knowledge in predicting climate change attitudes ($b = -0.14$, $SE = 0.04$, $t = -3.41$, $p = .001$, $\Delta R^2 = .03$).

Table VII: Conditional Indirect Effects at Values of Environmental Knowledge

Environmental Knowledge	Effect	Boot SE	LLCI	ULCI
Low (-1 SD)	0.18	0.05	0.10	0.29
Mean	0.13	0.03	0.08	0.20
High (+1 SD)	0.07	0.03	0.02	0.13

Conditional indirect effects at low, mean, and high levels of environmental knowledge (Table 7) showed that the indirect effect of discourse exposure on attitudes through dissonance was strongest among students with low environmental knowledge (effect = 0.18, 95% CI [0.10, 0.29]) and weakest among those with high environmental knowledge (effect = 0.07, 95% CI [0.02, 0.13]).

Table VIII: Index of Moderated Mediation

Index	Boot SE	LLCI	ULCI
-0.06	0.02	-0.11	-0.02

The index of moderated mediation (Table 8) was significant (index = -0.06, SE = 0.02, 95% CI [-0.11, -0.02]), confirming that environmental knowledge significantly moderated the mediating pathway (H3 supported).

IV.DISCUSSION

This study examined cognitive dissonance as a mediator of the relationship between climate change discourse exposure and climate change attitudes, with environmental knowledge tested as a moderator, among 250 Pakistani university students. Three key findings emerged, each consistent with the theoretical framework outlined earlier. First, discourse exposure was positively associated with cognitive dissonance, and dissonance in turn significantly predicted climate change attitudes, producing a significant indirect effect. This confirms cognitive dissonance as a genuine mediating mechanism, supporting Festinger's (1957) original proposition that conflicting cognitions generate psychological discomfort that shapes subsequent belief and attitude formation. The finding also extends this logic into a media-exposure context: repeated encounters with conflicting climate narratives on social media appear to function much like any other source of cognitive inconsistency, triggering the discomfort that Elliot and Devine (1994) operationalized as dissonance. This aligns with Treen et al.'s (2020) observation that social media exposes users to scientific and misleading content within the same feed, and supports the broader claim that platforms characterized by echo chambers and polarized discourse (Williams et al., 2015; Roxburgh et al., 2019) create fertile ground for psychological conflict rather than straightforward belief updating.

Second, and more novel, environmental knowledge significantly moderated the relationship between dissonance and attitudes. The conditional indirect effects make this pattern concrete: among students with low environmental knowledge, the indirect effect of discourse exposure on attitudes through dissonance was strongest, while among those with high environmental knowledge, it was weakest, with the index of moderated mediation confirming this as a statistically reliable pattern. In practical terms, this suggests that for students with limited environmental knowledge, attitude formation is more strongly driven by the discomfort of encountering conflicting information — consistent with the avoidance and inconsistency patterns Geiger et al. (2019) associate with underdeveloped objective knowledge. For students with greater environmental knowledge, dissonance played a comparatively smaller role in shaping attitudes, suggesting that knowledge may allow individuals to process conflicting information through more stable, reasoned evaluation rather than reactive discomfort — a pattern broadly consistent with Abousoliman et al. (2024) finding that greater climate knowledge is associated with reduced psychological distress.

This should not be read as evidence that knowledgeable individuals experience no dissonance. Rather, the data suggest that knowledge changes how dissonance translates into attitude change: it appears to buffer attitudes from being shaped primarily by momentary discomfort. This nuance is important, because it does not fully align with a simpler “knowledge resolves conflict” narrative; it is also consistent with observations elsewhere in the literature that greater knowledge can sharpen awareness of inconsistency even as it stabilizes eventual attitudes (Geiger et al., 2019). Future qualitative work could help clarify whether high-knowledge individuals experience less dissonance to begin with, or experience it but resolve it through different cognitive strategies than their less-knowledgeable peers. Third, the findings should be read in light of the broader identity-protective and motivated-reasoning literature. Hart and Nisbet (2012) and Feygina et al. (2010) both demonstrate that individuals do not process threatening information neutrally; system- or identity-protective motives can push dissonance toward denial rather than resolution. The present sample's positive relationship between dissonance and supportive climate attitudes suggests that, unlike the polarized Western samples in much of this literature, Pakistani university students facing direct and visible climate risk (Eckstein et al., 2021) may be less prone to defensive denial and more likely to resolve dissonance in the direction of belief updating — though this interpretation remains speculative given the cross-sectional design.

Limitations

Several limitations warrant caution. The cross-sectional design precludes causal claims; mediation and moderation patterns are consistent with the proposed theoretical model but cannot rule out reverse or reciprocal relationships between attitudes and dissonance. The sample relied on convenience sampling from social media–recruited participants, which may skew toward more digitally engaged and socially active students, limiting generalizability to the broader Pakistani student population. All measures were self-reported, introducing potential common-method bias, and the discourse exposure and attitude measures were researcher-adapted rather than independently validated instruments, which may affect measurement precision despite the pilot testing conducted. Finally, the objective knowledge measure was brief (five items), which may not fully capture the construct's breadth.

V. CONCLUSION

This study provides evidence that cognitive dissonance meaningfully mediates the relationship between social media–based climate change discourse exposure and climate change attitudes among Pakistani university students, and that this mediating process is shaped by environmental knowledge. Students with lower environmental knowledge appeared more susceptible to having their attitudes driven by the discomfort of conflicting information, while those with greater knowledge showed a comparatively weaker link between dissonance and attitude formation — suggesting knowledge may stabilize attitudes against the reactive pull of psychological discomfort. These findings extend cognitive dissonance theory into a developing-country, social-media-exposure context that remains underrepresented in the literature, and offer practical direction for climate communication: messaging strategies that pair conflicting or corrective climate information with environmental knowledge-building may be more effective than exposure alone in producing stable, supportive attitudes, particularly among less knowledgeable youth populations. Given Pakistan's acute and ongoing climate vulnerability, strengthening environmental knowledge among university students may serve not only an educational purpose but a psychological one — helping insulate attitude formation from the disorienting effects of the conflicting information that increasingly characterizes the online climate discourse this generation encounters daily. Future research using longitudinal or experimental designs, validated instruments, and more representative sampling would help confirm and extend these findings.

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