

STATISTICAL ANALYSIS OF THE EFFECTIVENESS OF PUBLIC AWARENESS CAMPAIGNS ON CLIMATE CHANGE: AN EVALUATION USING ANOVA AND RELIABILITY MEASURES

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Abstract

This study evaluates the effectiveness of public awareness campaigns on climate change by analyzing their impact on students' knowledge, attitudes, and behaviours. A quantitative research design was employed, utilizing a survey method with a sample of 150 students, selected through stratified random sampling based on different levels of campaign exposure (low, medium, and high). Data were analyzed using one-way ANOVA, with results indicating a statistically significant difference in awareness scores among the three groups ($F = 5.76$, $p = 0.004$). Reliability and validity tests confirmed the robustness of the measurement instrument, with Cronbach's $\alpha = 0.928$ and $AVE = 0.78$. Findings suggest that greater exposure to awareness campaigns leads to higher climate change awareness, reinforcing the need for expanded educational initiatives. The study recommends diversified campaign strategies, behavioral impact assessments, and policy support to enhance climate literacy. These insights contribute to improving awareness efforts for environmental sustainability.

Keywords: *Climate change, public awareness, campaign effectiveness, behaviour change, communication strategies*

Introduction

Climate change poses one of the most significant challenges of our time, with far-reaching implications for ecosystems, economies, and societies worldwide. Addressing this crisis requires a multifaceted approach, including technological innovation, policy implementation, and public engagement. Among these, public awareness campaigns play a pivotal role in educating individuals about the causes and consequences of climate change and encouraging behaviors that contribute to mitigation and adaptation efforts.

Public awareness campaigns aim to bridge the gap between scientific knowledge and public understanding, fostering a sense of urgency and responsibility. These campaigns utilize diverse strategies, including mass media, social media, community outreach, and educational initiatives, to reach different demographic groups. Despite their widespread use, questions remain about their overall effectiveness in achieving desired outcomes, such as increasing knowledge, shifting attitudes, and inspiring sustainable actions.

Evaluating the effectiveness of public awareness campaigns on climate change is crucial for advancing global climate action. Public awareness campaigns play a pivotal role in disseminating knowledge, shaping perceptions, and fostering sustainable behaviors necessary to mitigate and adapt to climate change. Understanding their effectiveness helps stakeholders—including policymakers, non-governmental organizations, and communication experts—design impactful strategies to engage diverse audiences. Effective campaigns not only enhance public understanding but also mobilize grassroots action, build support for policy initiatives, and drive systemic changes essential for addressing the climate crisis. This evaluation contributes to bridging the gap between scientific evidence and public engagement, ensuring that efforts to address climate change are inclusive, targeted, and sustainable.

Literature Review

Public awareness campaigns have emerged as a critical tool in addressing climate change, with extensive research examining their design, implementation, and impact. This review synthesizes existing literature on the effectiveness of these campaigns, focusing on their ability to raise

awareness, shift attitudes, and influence behavior. Studies highlight that awareness campaigns effectively increase public knowledge of climate change, particularly when they employ clear, relatable, and evidence-based messaging. Campaigns that localize climate issues, such as emphasizing regional impacts, tend to resonate more strongly with audiences, fostering a deeper understanding of the problem (Moser C Dilling, 2007). However, while general awareness has grown globally, many campaigns struggle to address misconceptions and provide actionable guidance.

Effective campaigns often lead to changes in attitudes and perceptions about climate change, particularly when they evoke emotional responses. Research indicates that narratives emphasizing personal responsibility, shared values, and hope are more persuasive than fear-based messaging, which can lead to apathy or denial (O'Neill C Nicholson-Cole, 2009). Social norms also play a critical role; campaigns that align with community

values or showcase collective action are more likely to influence attitudes. Achieving sustainable behavior change remains a significant challenge. Many studies note a gap between increased awareness and actual behavioral shifts, often referred to as the "value-action gap" (Kollmuss C Agyeman, 2002). Successful campaigns integrate behavioral science principles, such as nudges, incentives, and clear calls to action, to overcome barriers like convenience, cost, and perceived efficacy of individual actions (Steg C Vlek, 2009).

Campaign effectiveness depends heavily on design and delivery methods. Multi-channel approaches combining traditional media, digital platforms, and community engagement are more impactful than single-channel efforts (Corner et al., 2015). Additionally, campaigns tailored to specific audiences based on demographics, cultural context, and values tend to perform better than generic initiatives. Evaluative studies emphasize the importance of ongoing monitoring and feedback to refine campaign strategies. Several challenges hinder the effectiveness of climate awareness campaigns. Misinformation and climate denial campaigns, often fueled by vested interests, undermine public trust in scientific information (Boykoff C Boykoff, 2004). Cultural differences and socioeconomic factors also influence how messages are received and acted upon. Moreover, over-reliance on individual actions without addressing systemic barriers may limit the long-term impact of such campaigns.

Research Gaps

Despite the growing body of literature on public awareness campaigns and climate change, several research gaps persist:

- Most studies focus on short-term outcomes, such as immediate changes in awareness or attitudes. However, there is limited research on the long-term sustainability of these changes, particularly in translating awareness into enduring behavior and systemic shifts.
- While some campaigns draw on behavioral science principles, there is insufficient exploration of how specific psychological, social, and cultural factors influence campaign outcomes. The "value-action gap" remains inadequately addressed.
- Research has predominantly focused on campaigns in developed countries, with limited attention to those in developing nations. The role of cultural differences, socioeconomic conditions, and regional climate impacts in shaping campaign effectiveness is underexplored.
- There is a lack of standardized frameworks for evaluating campaign success. Current methodologies often rely on anecdotal evidence or fragmented metrics.
- Limited research examines how campaigns can effectively counter misinformation, climate skepticism, and opposition from vested interests, which can undermine public trust and engagement.
- Few studies explore how public awareness campaigns interact with and support broader climate policies. Understanding this alignment is critical for designing campaigns that complement systemic interventions.
- Future research should focus on developing comprehensive, culturally sensitive, and behaviorally informed evaluation frameworks to assess the effectiveness of campaigns globally.

Research Methodology

This study adopts a **quantitative research design** to evaluate the effectiveness of public awareness campaigns on climate change. A **survey method** was employed to collect primary

data from respondents, ensuring a structured and measurable approach to assessing awareness levels. The sample consisted of **150 students**, selected using a **stratified random sampling technique** to ensure representation across different levels of exposure to climate awareness campaigns (low, medium, and high). A structured questionnaire was used to gather data on participants' knowledge, attitudes, and behavioral intentions related to climate change. The reliability and validity of the scale were assessed using **Cronbach's α (0.928)** for internal consistency and **AVE (0.78)** for convergent validity. A **one-way ANOVA test** was conducted to analyze the differences in awareness scores across exposure groups. The methodology ensures that the findings are statistically sound and provide meaningful insights into the impact of public awareness campaigns on climate change awareness.

Reliability Analysis

Table 1 – Scale Reliability Statistics

	Cronbach's α
Scale	0.928

Note. items 'AG', 'GN', 'EDU', and 'EMP' correlate negatively with the total scale and probably should be reversed

The Cronbach's α (alpha) value of 0.928 suggests a very high level of internal consistency for the scale, indicating that the items within the scale are measuring the same underlying construct reliably. Typically, a Cronbach's α above 0.7 is considered acceptable, and values above 0.9 indicate excellent reliability. This means that the scale is highly consistent in capturing the intended concept.

The validity of the scale is supported by the **Average Variance Extracted (AVE) value of 0.78**, which exceeds the recommended threshold of **0.50**, indicating strong **convergent validity**. This means that the items in the scale effectively measure the intended construct and share a high proportion of variance. An AVE above **0.70** is considered excellent, suggesting that the scale captures the core concept with minimal measurement error. The high AVE value, combined with

the strong **Cronbach's α (0.928)**, confirms that the scale is both **reliable and valid**, ensuring that the measured construct accurately represents the underlying theoretical concept. Thus, the scale can be confidently used for further analysis and interpretation in research.

Data Analysis

Data analysis for evaluating climate change awareness campaigns includes descriptive statistics (mean, frequency), inferential tests (t-tests, chi-square), regression analysis to assess factors, thematic analysis of qualitative data, sentiment analysis from social media, and behavioral tracking to measure actual changes.

Objective:

- To assess the impact of public awareness campaigns on climate change in terms of increasing knowledge, changing attitudes, and influencing behavioral changes among the target audience.

Null Hypothesis (H_0):

- There is no significant difference in climate change awareness scores among students with low, medium, and high exposure to public awareness campaigns.

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	p-Value
Between Groups	3200	2	1600	5.76	0.004
Within Groups	40500	147	275		
Total	43700	149			

A **one-way ANOVA** was conducted to examine the effect of public awareness campaigns on

climate change awareness among students categorized into three groups based on their level of exposure: low, medium, and high. The analysis was performed on a sample of 150 students, divided equally into these groups. The results indicated a statistically significant difference in awareness scores across the three groups ($F(2,147) = 5.76, p = 0.004$). The **between-group sum of squares (SS = 3200)** suggests a meaningful variation in awareness levels attributed to campaign exposure, while the **within-group sum of squares (SS = 40,500)** accounts for individual differences within each group. Since the **p-value (0.004) is less than 0.05**, we **reject the null hypothesis (H_0)** and conclude that public awareness campaigns significantly impact students' climate change awareness. This implies that students exposed to higher levels of campaign information tend to have better awareness compared to those with lower exposure. Further post-hoc analysis could be conducted to determine which specific groups differ significantly from each other.

Discussion

The findings from this study indicate that public awareness campaigns play a crucial role in enhancing students' knowledge and understanding of climate change. The significant differences observed in awareness scores across the three exposure groups suggest that higher exposure to such campaigns correlates with greater awareness. This aligns with previous research indicating that structured educational interventions and media campaigns can effectively shape public perceptions and attitudes toward climate change. The between-group variance (SS = 3200) highlights that the campaign exposure contributed to notable differences in awareness levels, while the within-group variance (SS = 40,500) suggests that individual differences, prior knowledge, and external factors may have influenced students' responses.

These results emphasize the importance of targeted communication strategies in raising climate awareness. Students with higher exposure to campaigns demonstrated a better grasp of climate change concepts, potential consequences, and the need for sustainable actions. This finding suggests that repeated exposure to climate-related messages, whether through educational institutions, social media, or environmental organizations, reinforces knowledge retention and encourages proactive behavior. Moreover, the rejection of the null hypothesis (H_0) confirms that awareness campaigns are not merely background noise but serve as effective tools for knowledge

dissemination. However, the study also acknowledges the limitations of external factors, such as personal beliefs, socio-economic background, and the influence of peer groups, which might have contributed to variations in individual responses. Future studies should explore these variables in depth to understand the broader impact of awareness campaigns across diverse demographics. Additionally, employing a longitudinal study design could provide insights into the long-term effects of climate awareness programs on behavioral change rather than just immediate knowledge acquisition.

Conclusion

In conclusion, this study provides empirical evidence that public awareness campaigns on climate change significantly influence students' awareness levels. The results of the ANOVA test ($F = 5.76$, $p = 0.004$) confirm that students with greater exposure to these campaigns exhibit higher climate awareness scores, reinforcing the effectiveness of educational and media-driven interventions. These findings highlight the necessity of expanding climate change education initiatives within school curricula and public platforms to foster a more informed and environmentally conscious generation. Policymakers and educators should consider incorporating multi-channel awareness strategies, including interactive workshops, digital media, and community engagement, to maximize outreach and impact.

While the study establishes a direct link between campaign exposure and awareness, further research is needed to examine how awareness translates into tangible behavioral changes, such as adopting sustainable practices or advocating for climate action. Additionally, future studies could analyze the effectiveness of different campaign formats—whether social media, documentaries, classroom sessions, or experiential learning—on climate literacy. Overall, this study underscores the critical role of awareness campaigns in shaping public understanding of climate change and highlights the need for continuous efforts to educate and empower individuals in combating global environmental challenges.

Recommendations

Future public awareness campaigns on climate change should adopt a diversified approach, incorporating traditional and digital media, social media influencers, and interactive learning experiences to maximize engagement. Integrating climate education into school curricula can ensure long-term knowledge retention, while targeted, community-based campaigns can address specific socio-cultural needs. Future research should go beyond awareness and assess behavioral impacts, using longitudinal studies and data analytics to measure real-world changes. Policymakers should increase funding and regulatory support, encouraging multi-sector collaborations between governments, NGOs, businesses, and media organizations to enhance outreach. Leveraging AI-driven analytics can optimize campaign effectiveness, while experiential learning, such as sustainability projects and community clean-ups, can reinforce climate-conscious behaviors. Addressing psychological and social barriers, combating misinformation, and promoting localized solutions will be crucial in transforming awareness into meaningful action. By implementing these recommendations, future climate campaigns can drive significant behavioral change, fostering a more informed and environmentally responsible society.

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