

Effective Elements of Climate Change Videos on the YouTube Platform

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Abstract: In an era where visual communication is important, understanding the key components that make climate change videos effective is essential for improving awareness and driving meaningful actions. This research presents an overview of YouTube's educational content on climate change, aiming to identify elements that contribute to the effectiveness of these videos. We used a questionnaire targeting bachelor's and master's students to learn about their preferences regarding the available videos and their beliefs concerning the use of YouTube as an educational platform. A curated list of videos was used to explore how students perceive their influence on personal interest and engagement in climate change. Accordingly, each student watched three videos related to climate change and provided information concerning their impressions. By reviewing various attributes of the videos related to climate change, such as the content structure, engagement, and similar, we extracted the essential characteristics that are associated with more positive reactions to these videos as significant educational tools.

Keywords: YouTube platform, Climate changes, Content-based analysis

1. Introduction

Climate change is widely recognized as a major problem for our society. According to the Fourth National Climate Assessment report, the world's climate will keep changing in the next century, and how much it changes depends on the gases people release into the air. The impacts of climate change include more extreme weather, problems with water and food, harm to animals and plants, higher temperatures, and risks to human health. It is important to involve the public more to help deal with climate change through better education, especially for younger people who will experience the effects of today's decisions. In the modern landscape of digital communication, YouTube has emerged as a potent platform for disseminating information and shaping public discourse. With climate change standing as one of the most pressing global challenges, the need to understand how this critical topic is shown and received on YouTube becomes essential. This study presents a comprehensive exploration, employing content-based analysis techniques to explore the user engagement dynamics with climate change content. Unlike traditional research approaches, our focus extends the content itself to examine user preferences, reactions, and the educational prospects offered by YouTube in the area of climate change awareness. As climate-related issues become increasingly connected with community concerns, examining the complexity of user interactions on this popular platform becomes not only relevant but crucial for informed and effective communication strategies. The details in this study promise to enrich our understanding of how YouTube can serve as a climate change awareness and education.

2. Literature Review

While most people express a collective concern for environmental protection and addressing climate change, there exists a notable division regarding the noticed factors underlying these environmental challenges within the public. This division assumes significance considering the extensive behavioral and policy changes required to effectively address climate change. Many people believe that few are doing things about climate change because they see it as something far away and happening in the future.

Wolf, J. and Moser, S.C., (2011), Shahbazi, Z. and Byun, Y.C., (2021) presents that social media platforms have become widely popular channels for accessing information on subjects like science on a global scale. With over 2 billion users spanning diverse levels of science reading skills and age groups, YouTube stands out as one of the most frequently visited websites, offering easily accessible information. Despite existing studies exploring the connection between social media, public awareness, and engagement with climate change, there is a notable gap in comprehensive research concerning the nature of climate change-related information available on YouTube. Social media platforms offer an avenue for certain segments of the public to express opinions and actively participate in discussions about climate change. In comparison to presented work, they point out on a gap in comprehensive research specifically regarding the climate change-related content on YouTube, emphasizing the potential for public engagement and discussion on social media platform.

Feygina et al. (2020) discovered that promoting climate change through public media channels enhances public engagement. Cody et al. (2015) employed sentiment analysis to assess responses to climate change news, events, and natural disasters shared on Twitter. Uldam, J. and Askanius, T. (2013) delved into YouTube comments related to issues on climate conferences, aiming to grasp viewers' attitudes toward politics and political involvement. Shapiro, M.A. and Park, H.W. (2018) utilized network structures to compare discussion networks within videos, identifying co-comments across various video discussions. These works are focusing on various objectives such as assessing public engagement with climate changes and comparing the discussion network within videos and in comparison with the presented study it differs from using the educational platform to identify the effectiveness of these videos.

Lorenzoni, I., Nicholson-Cole, S. and Whitmarsh, L. (2007) presented active public participation plays a crucial role in addressing the challenges posed by climate change. Effectively altering individual behavior can contribute positively to climate change reduction efforts. The connection between individuals' thoughts, emotions, and subsequent actions regarding climate change is clear. Involvement in climate change is showing an assessment involving cognitive (thoughts), emotional (feelings), and behavioral (actions) elements. In comparison, we incorporate user sentiments recorded in the questionnaire, and respondents assign ratings to the videos based on these sentiments.

The study presented by Meza, X.V., Shapiro, M. and Park, H. (2018) investigates public responses to the trailer of *Before the Flood*, a climate change documentary released in October 2016. Using semantic analysis, the research explores emotions related to climate change. A comparison of sentiment in comments on videos from previous studies is made with comments on the *Before the Flood* trailer. The study identifies key influencers in the comment network, analyzes their discourse, and reveals a heightened politicization of comments, influenced by the ongoing U.S. electoral campaign. Despite a decrease in the use of scientific terms, sentiment towards climate change remains stable. This research contributes to the intersection of webometrics and environmental psychology, demonstrating its utility in analyzing media, especially when targeting a global audience. In comparison with the proposed research work, Meza, X.V., Shapiro, M. and Park, H. (2018), Shahbazi, Z. and Byun, Y.C., (2022) mostly focus on sentiment analysis techniques to extract the emotions based on comments and it differs with exploring the user engagement dynamics with climate changes contents.

The study proposed by Duran-Becerra, B. et al. (2020) looks at the most popular YouTube videos about climate change. They searched for the top 100 videos on YouTube using the term climate change. Videos in languages other than English or those deemed irrelevant were not included. The researchers used a fact sheet from NASA to create categories for the video content, and then they coded the videos based on these categories. The goal is to understand what kind of content people are watching the most on YouTube when it comes to climate change.

The study presented by Effrosynidis, D., Sylaios, G. and Arampatzis, A. (2022) investigates how information about global warming and climate change is shared on the internet, focusing on YouTube videos. The researchers analyzed the top 10 most popular videos on this topic, examining how the science of climate change is presented in these videos.

The study proposed by Shapiro, M.A. and Park, H.W. (2015) established the narrative of each video and then analyzed public responses and engagement through comments. The findings reveal that, regardless of the video's content, comments mostly revolved around the science of climate change, often discussing the topic in general rather than specific videos. Without moderators, YouTube users added their thoughts to these popular videos, emphasizing evidence of weak, strong, or politicized science.

The research proposed by Allgaier, J. et al. (2019) explores the content of climate-related videos on YouTube, focusing on whether they align with or challenge scientific consensus views. The study analyzed 200 videos using ten search terms related to climate science, climate change, and climate engineering. The findings reveal that a majority of the videos (107 out of 200) support worldviews opposing scientific consensus, including denial of anthropogenic climate change and propagation of conspiracy theories. Surprisingly, videos supporting the scientific mainstream view received only slightly more views than those opposing it. The research emphasizes the need to understand strategically distorted communications about climate issues online and critically analyze them.

3. Methodology

In this section, we describe the detailed process we employed for the content-based analysis of climate change videos on the YouTube educational platform. Figure 1 illustrates the proposed methodology details.

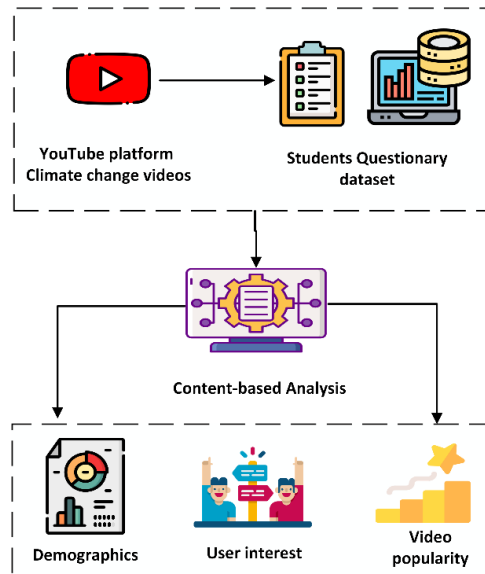


Figure 1: Content-Based Analysis Flowchart

In the first step, we selected 12 videos related to climate change from the YouTube platform and randomly distributed three videos among 60 students from bachelor's and master's university levels. Table 1 shows the list of videos that students watched in this process and Table 2 show the list of majors that students contributed to this questionnaire.

Table 1: List of videos

#	Videos Title
1	What Greta Thunberg does not understand about climate change Jordan Peterson
2	Climate Scientist Answers Earth Questions From Twitter Tech Support WIRED
3	Is It Too Late To Stop Climate Change? Well, it's Complicated.
4	MOTHER NATURE'S RAGE Effects of climate change in Kenya's coast region
5	Climate Science: What You Need To Know
6	What the Hockey Stick missed about climate change
7	Climate Change Explained Simply
8	Discussing The Impact Of Climate Change: NASA's New Project Symone
9	Climate Change – We are the PROBLEM & the SOLUTION (Animated Infographic)
10	Jordan Peterson criticizes climate change Lex Fridman Podcast Clips
11	When The World Gets 1°C Hotter Climate Change: The Facts BBC Earth
12	Famine propelled by conflict and climate change threatens millions in Somalia

Table 2: List of majors

#	Majors
1	AI and Data Science
2	Computer Engineering
3	Computer Science
4	Development Engineering
5	Master in Embedded System
6	Master in IT
7	Information Technology

In the next step, we prepared a questionnaire form that contains three sections, as follows:

- Section one includes six questions concerning the responder's demographics.
- Section two includes 13 questions related to the specific climate change video that describe the student's engagement and perceptions.
- Section three includes the six questions related to perceptions toward YouTube use in the learning process. Table 3 shows the details of the questionnaire used in this study.

Table 3: Shows the questionnaire details

Demographics	Gender Age University What do you study Are you an undergraduate or postgraduate student Year of study
Video engagement perceptions	The video helped me understand the topic of climate change better. The topic was well-explained in the video. The video was easy to learn from. I found the video educationally useful. The topic of the video was easy to understand. I found the video relevant to the topic of climate change. The video keeps my attention. I think that I was fully focused on the content of the video. I felt engaged to the video I just saw. I found the video enjoyable. I found the video interesting. I found the video concise. The video uses conversational language.
General perceptions toward YouTube use in the learning process.	The Use of YouTube can enhance the learning process. I would like to have YouTube incorporated in my classes. The videos can enhance my learning/understanding of course content. The videos can create a more exciting learning environment. YouTube can make classes more interesting. The use of YouTube as a learning tool can engage me to the content of the course.

The questionnaire file for each video was filled separately, and in total, we have 180 responses from 60 students who shared their answers for the above-defined three sections. Based on the collected information, we have

performed a content-based analysis to evaluate user's interest and the impact in terms of climate change videos and their interest in using YouTube as an educational and learning platform.

3.1 Content-Based Analysis

In this study, a content-based analysis was conducted to explore user engagement with climate change videos on YouTube. The research involved gathering and analyzing 180 responses from university students who participated in a questionnaire focused on their preferences and perceptions regarding these videos. The study not only showcased diverse user preferences but also detailed broader interests related to integrating YouTube as an educational tool. The findings highlighted the dynamics of user interaction with climate change content, emphasizing YouTube's potential as a valuable platform for educational purposes.

3.2 Demographics

Initiating this process involves inquiries related to demographics, with Halmstad University bachelor's and master's students being the primary focus. This questionnaire section aims to gather data on participants' ages, academic majors, genders, and years of study. The significance of these inquiries lies in clarifying the differences in students' interest in climate change videos. The design intends to provide an understanding of the prevalent sentiments and preferences among different student subgroups.

3.3 User Interest

In this phase, each student actively interacts with three specifically assigned videos, providing valuable subjective insights and evaluations regarding the content that they watch. Students share their perspectives on the videos, conducting a detailed analysis of their interest levels and understanding the presented material. Furthermore, they express their emotional responses to the climate change-related content and critically assess whether the videos effectively encourage thoughts on the topic. Essential to this comprehensive procedure, students assign ratings to the videos, capturing their level of interest and engagement with the presented content. This approach aims to show the different responses of the students, contributing to a comprehensive understanding of the impact and effectiveness of the selected climate change videos.

3.4 Video Popularity

Examining the collective responses from students related to their interest in the watched videos, a comprehensive dataset of 180 responses was collected. Through content-based analysis, we reviewed data to disclose valuable insights. This analytical process allowed us to recognize the high-ranked videos among the 12 options. The video rankings were based on the users' evaluations of their individual levels of interest in the content presented. This approach provides an understanding of the preferences and engagement levels of the students, clarifying the most impactful climate change video in the context of the study.

4. Results

In this section, we explore the details of our analysis regarding YouTube videos on climate change. The first step of our methodology involves an in-depth examination of individual videos focusing on the differences between male and female viewers. The objective is to recognize any gender-based variations in the viewership of each specific video. Table 4 provides detailed insights into the viewership statistics for each video.

Table 4: Video-Specific Watched Records Based on Gender

Videos	Participants	
	Male	Female
Video 1	11.82%	3.44%
Video 2	4.30%	11.49%
Video 3	10.75%	5.74%
Video 4	10.75%	6.89%
Video 5	9.67%	8.04%
Video 6	8.60%	5.74%
Video 7	4.30%	13.79%
Video 8	6.45%	10.34%

Videos	Participants	
	Male	Female
Video 9	9.67%	9.19%
Video 10	8.60%	9.19%
Video 11	6.45%	8.04%
Video 12	8.60%	8.04%

Following the information presented in Table 4, Figure 2 illustrates the demographic distribution based on gender among participants. The collected data indicates that 51.67% of individuals expressing interest in participating in our questionnaire identified as male, while 48.33% identified as female.

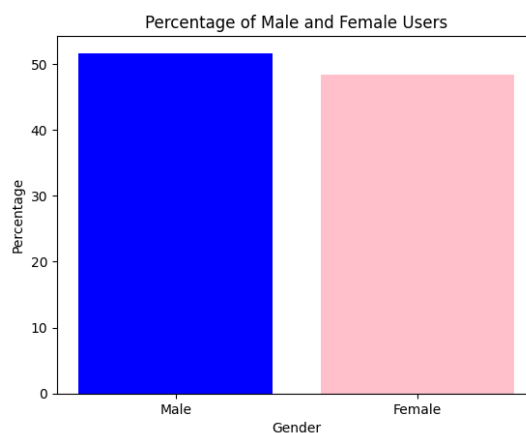


Figure 2: Participants' gender details.

Considering the 180 collected responses, the videos were randomly assigned to students, as detailed in Table 4, presenting the count of views each video received. Subsequently, we computed the average rating for each video by considering the responses to 14 questions posed to students regarding their perception of the watched videos. These questions aimed to measure the level of interest and understandability of the videos. The rating scale ranged from 1 to 5, with "strongly agree" assigned a value of 5, "agree" = 4, "undecided" = 3, "disagree" = 2, and "strongly disagree" = 1. We assigned the questionnaire to 108 students, where, in an ideal world, each video would be evaluated by 27 students. However, we only got responses from 60 students. This means that not every video was watched by the same number of students. The responses collected are summarized in Table 5. The main reason for the differences between the watch counts is the fact that not all the students replied to the questionnaire.

Table 5: Students' rating results

Videos	Watched Count	Average Rating
Video 9	17	3.85
Video 4	16	3.84
Video 7	16	3.84
Video 10	16	3.98
Video 5	16	3.81
Video12	15	3.53
Video 3	15	3.98
Video 8	15	3.33
Video 2	14	3.75
Video 1	14	3.46
Video 11	13	3.86
Video 6	13	3.18

Moreover, the further analysis in this study delved into the reports of different age groups and their interest in the climate change videos they watched. Table 6, presented below, provides a detailed breakdown of the age groups and their average ratings, offering valuable insights into how various demographic factors may influence viewer engagement with climate change content on YouTube.

Table 6: Average rating based on the age group

Age Group	Most Watched Video	Average Rating
0-20	MOTHER NATURE'S RAGE Effects of climate change in Kenya's coast region	3.9846
21-30	Climate Change Explained Simply	3.9835
31-40	When The World Gets 1C Hotter Climate Change: The Facts BBC Earth	3.8698
41-50	What Greta Thunberg does not understand about climate change Jordan Peterson	3.8506

Table 7 presents a breakdown of participants' majors and their corresponding average ratings assigned to the climate change videos. This analysis aimed to explore potential variations in viewer engagement based on academic backgrounds and fields of study.

Table 7: Average rating based on the majors

Majors	Most Watched Video	Average Rating
AI and Data Science	What Greta Thunberg does not understand about climate change Jordan Peterson	3.85
Computer Engineering	When The World Gets 1C Hotter Climate Change: The Facts BBC Earth	3.86
Computer Science	What the Hockey Stick missed about climate change	3.53
Development Engineering	Climate Scientist Answers Earth Questions From Twitter Tech Support WIRED	3.84
Master in Embedded System	Discussing The Impact Of Climate Change: NASA's New Project Symone	3.33
Master in IT	MOTHER NATURE'S RAGE Effects of climate change in Kenya's coast region	3.98
Information Technology	Climate Change Explained Simply	3.98

Following the examination of user interest in climate change videos, we proceed to assess user preferences regarding the utilization of YouTube as an educational tool within classroom settings. Conducting a real-time analysis, we quantify the average rating derived from students' responses to the incorporation of YouTube, as detailed in Table 8.

Table 8: User rating of YouTube usage as an educational platform

Questions	Average Rating
C1	4.16
C2	4.24
C3	4.16
C4	4.36
C5	4.32
C6	4.37

5. Conclusion

Our analysis presented user engagement with climate change videos on YouTube, revealing detailed dynamics. The study, based on student responses, assessed user interest, preferences, and video ratings. It identified impactful videos, considering gender distribution. Additionally, we explored YouTube's role in education, evaluating its efficacy and user perceptions. The research emphasizes the need for climate change education

videos, particularly for youth. Overall, our findings underscore the multifaceted aspects of user interaction with YouTube content, prompting further exploration of its effectiveness in climate change education.

6. Discussion

The findings of this study shed light on the effectiveness of YouTube's educational content in raising awareness about climate change and driving meaningful actions. One significant aspect revealed by this study is the importance of content structure in engaging viewers and fostering interest in climate change topics. Videos that effectively organized their content and presented information in a clear and concise manner tended to elicit more positive reactions from viewers. Additionally, aspects such as visual appeal, narrative coherence, and relevance of the content to viewers' interests emerged as influential factors in enhancing engagement with climate change videos. Furthermore, our research highlights the role of YouTube as a powerful platform for disseminating information and shaping public discourse on climate change. The accessibility and reach of YouTube enable it to serve as an effective medium for delivering educational content to a wide audience. By understanding how climate change topics are presented and received on YouTube, stakeholders can better leverage this platform to promote awareness and education about climate-related issues.

Despite the valuable insights gained from this study, several limitations should be acknowledged. The study's focus on bachelor's and master's students may limit the generalizability of the findings to broader populations. Future research could explore the perceptions and preferences of a more diverse demographic to provide a more comprehensive understanding of user engagement with climate change videos on YouTube. Finally, the study's focus on user perceptions and reactions to climate change videos may overlook other factors influencing engagement, such as algorithmic recommendations, social interactions, and cultural contexts. Future research could explore these factors to provide a more nuanced understanding of user dynamics on YouTube in the context of climate change awareness and education.

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