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REVIEW ARTICLE

Evaluating video-based science communications practices: a scoping review

Betty S. Lai, Alexa Riobueno-Naylor, Sarah Quan, Mauricio Montes, Jon Wargo and Mo Jones-Jang

Abstract

Despite the rising popularity of video-based platforms, systematic guidelines for developing effective video-based science communication remain scarce. Training scientists in these skills is vital for providing research-backed information for decision making and engaging audiences with science. This study reviewed evidence-based strategies for communicating science via video-based social media platforms, identifying 28 articles that included original video-based data and were published in the past decade. Articles were identified through library database searches, journal archives, and publication lists from relevant researchers. Predominantly focusing on YouTube (42.9%) and TikTok (28.6%), qualitative findings revealed best practices related to narrative structure, emotion and connection, video features, professionalism and quality, and social media strategies. Highlighting actionable strategies, this research provides valuable insights for scientists navigating the dynamic landscape of video-based science communication.

Keywords

Scholarly communication; Science and media; Science communication teaching

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1 ▪ Context

Many scientists enter their fields with the goal of making a meaningful impact on the world, whether by advancing knowledge or improving lives. However, the traditional pipeline from scientific discovery to practical application is often slow and inefficient. Social media now plays a pivotal role in rebuilding this pipeline by providing scientists with direct channels to share findings with the public. Effective dissemination of scientific knowledge increases the likelihood that these findings will be applied in real-world settings.

Science communication plays a pivotal role in translating complex scientific content into accessible formats for broad audiences [Lewenstein, 2022]. However, scientists often face challenges in effectively reaching broad audiences. The politicization of scientific issues, misinterpretation of findings, and intentional spread of false information pose significant threats to effective science communication with the public. Compounding these issues, many members of the public lack experience in critically evaluating the validity of scientific findings [Scheufele & Krause, 2019].

Despite ongoing efforts to address these obstacles, difficulties in science communication persist. Scientists are frequently absent from public discourse [Brossard & Scheufele, 2013]. To illustrate, only 72% of Americans are unable to name a living scientist [Research!America, 2021], and approximately 50% are able to correctly identify scientific hypotheses [Kennedy & Hefferon, 2019]. Importantly, disparities in scientific knowledge persist based on education level [Kennedy & Hefferon, 2019]. Video-based social media platforms offer a promising avenue to address disparities in scientific literacy by reaching audiences that may not have been previously engaged through traditional media or education systems, especially among younger generations. YouTube, for example, is used by roughly 90% of teens in the United States [Anderson et al., 2023] TikTok is another rapidly growing video-based platform with over 1.7 billion users worldwide [Iqbal, 2025] As of 2023, 60–70% of teens report using the platform in the United States [Anderson et al., 2023]. In addition, over one-third of U.S. adults report getting their news through TikTok [Leppert & Matsa, 2024]. Importantly, the platform has become an important source for sharing scientific information [Radin & Light, 2022; Allgaier, 2019; Hill et al., 2022]. The app's algorithm allows for users to be presented with scientific content that they may not have sought out on their own [Rein, 2023].

Despite the potential of video-based social media platforms, many scientists feel ill-equipped to effectively communicate research through videos [McNeal et al., 2021]. Therefore, this study aimed to review the literature on video-based science communication, identify best practices, and provide evidence-based guidelines to help scientists effectively disseminate their work to the public, whether individually or in collaboration with science communicators.

1.1 ▪ *The importance of video-based communication*

Historically, scientists could only communicate via video when invited to speak on media channels or other outlets [Dudo, 2013]. However, video-based platforms have transformed this communication landscape. Scientists no longer need to work through gatekeepers. Instead, scientists may create videos independently and distribute them through platforms like YouTube and TikTok [Howell & Brossard, 2019; Metag et al., 2023]. Understanding how to use these video platforms to engage audiences is a key way to share science and provide research-backed information to inform public decision making [Wang et al., 2019].

Video-based communication, as opposed to text-based or photo-based platforms (e.g., Facebook, op-eds), is particularly effective due to the combined visual and auditory elements of video, which enhance engagement and emotional resonance. Videos create stronger bonds between individuals than text [Sherman et al., 2013]. When audiences connect with engaging evidence-based content, there are numerous benefits. Audiences may gain a new perspective, engage in more health promoting behaviors, facilitate further conversations on a pressing science topic and even enact change. Understanding the principles of effective communication can help make scientific information more accessible and engaging for the public. Video is a powerful tool in this context, as it enables scientists to reach broader audiences, communicate complex topics in an engaging way, and foster public interest and trust in science.

Training scientists to effectively communicate findings from publicly funded research provides a valuable return on taxpayer investment by increasing public understanding, fostering transparency, and enhancing the societal impact of scientific discoveries. In 2022, the United States invested over $169 billion in research and development [National Center for Science and Engineering Statistics, 2023]. Ensuring these findings reach a broad audience maximizes the value of this investment. Dissemination is a core goal of many funding agencies, including the National Science Foundation and the National Institutes of Health, which prioritize the sharing of research outcomes to promote public knowledge and encourage further scientific inquiry [NIH Office of Disease Prevention, n.d.; U.S. National Science Foundation, n.d.]. By equipping scientists with communication skills, funders can ensure that scientific knowledge informs public decision-making, policy, and innovation, thereby amplifying the impact of federal research funding.

Science communication is pivotal in public awareness and informed decision-making related to personal health, public policies, and interactions with the natural environment [Pidgeon et al., 2014; Puri et al., 2020]. Equipping scientists with effective science communication skills has important public health benefits. Although science articles and news outlets will be a critical source of information, over one-third of U.S. adults get their news via TikTok in 2023, as mentioned above [Leppert & Matsa, 2024]. Scientific findings are frequently misrepresented and sensationalized in popular media [Dempster et al., 2022]. For example, van Atteveldt et al. [2014] found that communication about neuroscience often loses context and nuance due to the simplified nature of news reporting. Additionally, other studies have documented the misrepresentation of scientific research in areas such as cancer [Amberg & Saunders, 2020], genetics [Bubela & Caulfield, 2004], and clinical randomized controlled trials [Motl et al., 2005].

Studying science communication via video platforms is not a new endeavor. Researchers have examined video-based science communication for decades [e.g., Dornan, 1990; Kirsch, 1981]. This work has generally found that communication via video can be more effective and persuasive than text-based communication, such as in the case of climate change consensus [Goldberg et al., 2019]. Examining science communication in the context of new platforms (e.g., YouTube and TikTok) for communication, this study sought to answer two research questions:

Research Question 1. What is the state of research knowledge on science communication via video-based platforms, specifically focusing on studies with original video-based data published in the past decade?

Research Question 2. Based on an analysis of articles identified in our scoping review, what are effective, evidence-informed strategies for communicating science to broad audiences?

To answer these questions, we conducted a scoping review to be able to synthesize key factors related to science communication via video identified in the literature [Pollock et al., 2022]. We used a mixed-methods approach to analyze the articles identified in our review. We analyzed our articles quantitatively, and then qualitatively. We concluded by providing recommendations for best practices and future training.

2 ▪ Methods

The current study completed a quantitative and qualitative content analysis of data from peer-reviewed journal articles collected through a scoping review. The scoping review was registered as a study protocol via OSF. To maintain rigor and transparency, we adhered to the PRISMA-ScR checklist [Tricco et al., 2018] and PRISMA guidelines [Page et al., 2021], ensuring that all aspects of the study, including our search strategy, inclusion criteria, data extraction, and content analysis methods, were comprehensively detailed. Our review involved both quantitative and qualitative content analyses of data from peer-reviewed articles, allowing us to explore best practices within the field. In place of a registered protocol, the study provides extensive methodological details to support replicability and transparency in our Supplementary material. We are also sharing our methodology and findings openly, which aligns with the standards of scoping reviews and addresses transparency concerns.

The review was conducted in three phases: Phase 1) searching, Phase 2) analyzing, and Phase 3) evaluating risk of bias. Covidence [‘Covidence Systematic Review Software’, n.d.], a systematic and scoping review software, was used in Phase 1 and 2 for data collection and screening. The focus of this study was to evaluate recent studies that evaluated short-form science communication videos.

2.1 ▪ *Phase 1: article search strategy*

The first phase involved searching for, screening, and selecting articles. The research team collaborated with an experienced research librarian to determine best practices for the search strategy including database and journal selection. The search strategy involved systematically reviewing relevant article databases, journal archives, and publications from leading researchers in the field. Journals were selected based on their relevance to science communication, social media, and video-based research, informed by a librarian’s expertise and the study’s objectives. Additionally, we conducted targeted searches on Google Scholar to identify articles outside traditional databases and consulted with domain experts to ensure key journals and emerging publications were not overlooked.

To ensure quality, relevance, and alignment with our research objectives, we applied several eligibility criteria. First, we limited our selection to peer-reviewed articles to ensure credibility and reliability, as peer review serves as a standard for quality assurance in scholarly research. Articles were restricted to those published in English to maintain consistency in analysis and avoid potential misinterpretation of nuanced scientific communication practices due to language translation. We focused specifically on video communication for science topics, as this directly aligns with our research aim of evaluating the practices and effectiveness of video formats in disseminating scientific knowledge.

To ensure that our analysis was grounded in empirical evidence, we required articles to present original data derived from video content, thus excluding theoretical, review, and opinion articles. This criterion allowed us to focus on real-world applications and outcomes within video-based science communication. Finally, we restricted the publication date range to the past decade (January 2013–June 2023) to capture recent advances and trends in this rapidly evolving field, driven by technological progress and changing social media landscapes. These carefully selected criteria enabled us to compile a high-quality, relevant body of literature that would yield meaningful insights into current practices in video-based science communication on social media.

We searched six academic databases, including PsychInfo, PubMed, ERIC, GeoRef, Communication Abstracts/Communication and Mass Media Complete, and Scopus using the following search terms: (scien* OR tech OR technolog* OR environ* OR climate OR engineer* OR chemistry OR physics OR astronom* OR astrophysics OR biotech OR medic* OR nanotech* OR genetic*) AND ("scien* communicat*" OR "scien* public relation*" OR "public service announc*" OR PSA OR PR OR expert) AND (video* OR clips OR youtube OR film OR "motion picture" OR recorded OR recording OR instagram OR digital OR tiktok OR "tik tok" OR tedtalk OR "ted talk" OR broadcast OR online OR videotape OR TV OR televis* OR animat* OR reels OR vimeo OR documentar* OR social media). In addition, we used the search terms "science communication video" to gather potentially relevant articles from the first 300 results in Google Scholar. See the Supplementary material for a detailed example of the employed search strategy.

Next, we engaged in a three-part hand search, including searching peer-reviewed journals, top authors in the field, and the reference lists of the most cited and relevant articles. For the journal searches, we used the search term "video" to pull articles from the following 11 journals: Science Education, Science Communication, Public Understanding of Science, Environmental Communication, Science and Environmental Communication, Journal of Science Communication, Communication Research, Journal of Communication, PNAS, Technical Communication Quarterly, and Journal of Technical Writing and Communication. To evaluate potentially relevant articles from top scientists in the field, we searched the Google Scholar reference lists of 18 scientists within the field of science communication using Google Scholar labels "science communication" and "environmental communication". These scientists (listed in the Supplementary material, Table 2) ranged in age, gender, geography, and level of impact. Finally, we identified 12 of the most relevant and top-cited articles in our initial data corpus and hand-searched the reference lists.

All citations retrieved through the database search were uploaded into Covidence to facilitate screening and organization. Duplicate entries were identified and removed within Covidence. Two authors independently screened the remaining citations at the title level to assess initial relevance to the research question. Articles deemed relevant in the title screening proceeded to the abstract-level review, where the same two authors independently assessed each abstract against predefined eligibility criteria. In the final stage, a full-text review of all remaining articles was conducted by all authors to confirm their inclusion based on the full eligibility criteria.

2.2 ▪ *Phase 2: data analysis*

Phase 2 involved descriptive quantitative analysis and qualitative content analysis of findings from the final data corpus. Two coders coded study characteristics from each article. Coded quantitative information included journal name, publication year, location of the study, social media type that the study focused on, video characteristics (e.g., length, type, creator), size of participant sample (if applicable), study period, and methods. The same two coders engaged in a qualitative analysis, employing a thematic analysis approach [Braun & Clarke, 2006] to identify, analyze, and report patterns (themes and subthemes) within the findings of the included studies. Coded qualitative themes include storytelling techniques (e.g., the use of hooks and purposeful emotions) and social media findings (e.g., the use of relevant hashtags and video length). Coded content areas included key theories used to frame the study, samples and data used, methods employed, key findings, conclusions and implications, and study limitations. Content areas were reviewed and further coded into larger themes and subthemes. Once the themes and subthemes were completed, the coders pulled example videos from the articles within the sample that demonstrated the theme in practice.

2.3 ▪ *Phase 3: risk of bias evaluation*

The third phase involved evaluating study rigor using a 7-item risk of bias checklist [Ryan, 2013]. Evaluation criteria included: 1) clear research questions, 2) clearly defined variables of interest, 3) relevant and credible data, 4) minimal bias in sampling, 5) multiple coders (if applicable), 6) clear results, and 7) clearly stated implications. Each study was coded by two coders, and discrepancies were resolved in consultation with the entire research team. Studies were categorized as strong, moderate, or weak based on the number of "no" or "unclear" codes across criteria (Strong: ≤ 2; Moderate: 3–4; Weak: 5+). Strong studies demonstrated a low risk of bias, substantial rigor, and high internal/external validity. Moderate studies had some shortcomings in validity, rigor, or bias but were still of high enough quality to be used in the review. Weak studies had substantial shortcomings in validity, rigor, or bias, and their findings should be interpreted with caution.

3 ▪ Results

3.1 ▪ *Quantitative analysis of state of research knowledge*

Phase 1 of our analysis is shown in the CONSORT diagram in Figure 1. We identified 14,416 articles through database (n = 14,416) and hand searches (n = 247; 101 articles were identified from the journal search, 72 articles were identified from the hand search of top scientists, and 74 articles were identified from the reference list search). All articles were uploaded into Covidence for screening. Covidence identified 1,382 duplicates, which were removed. One coder reviewed the remaining 13,283 articles at the title level to assess for study relevance. A majority of articles were excluded due to their focus on using videos in school or museum-based science learning, writing-based scientific communication, and the communication of science in other forms of media (e.g., music, video games, television, movies). A total of 586 articles were then evaluated at the abstract level by two coders. Of those, 50 articles were identified for full-text screening. Full-text screening involved evaluating the articles against study eligibility criteria. Twenty-two articles were eliminated during full-text screening. The final data corpus consisted of 28 articles.

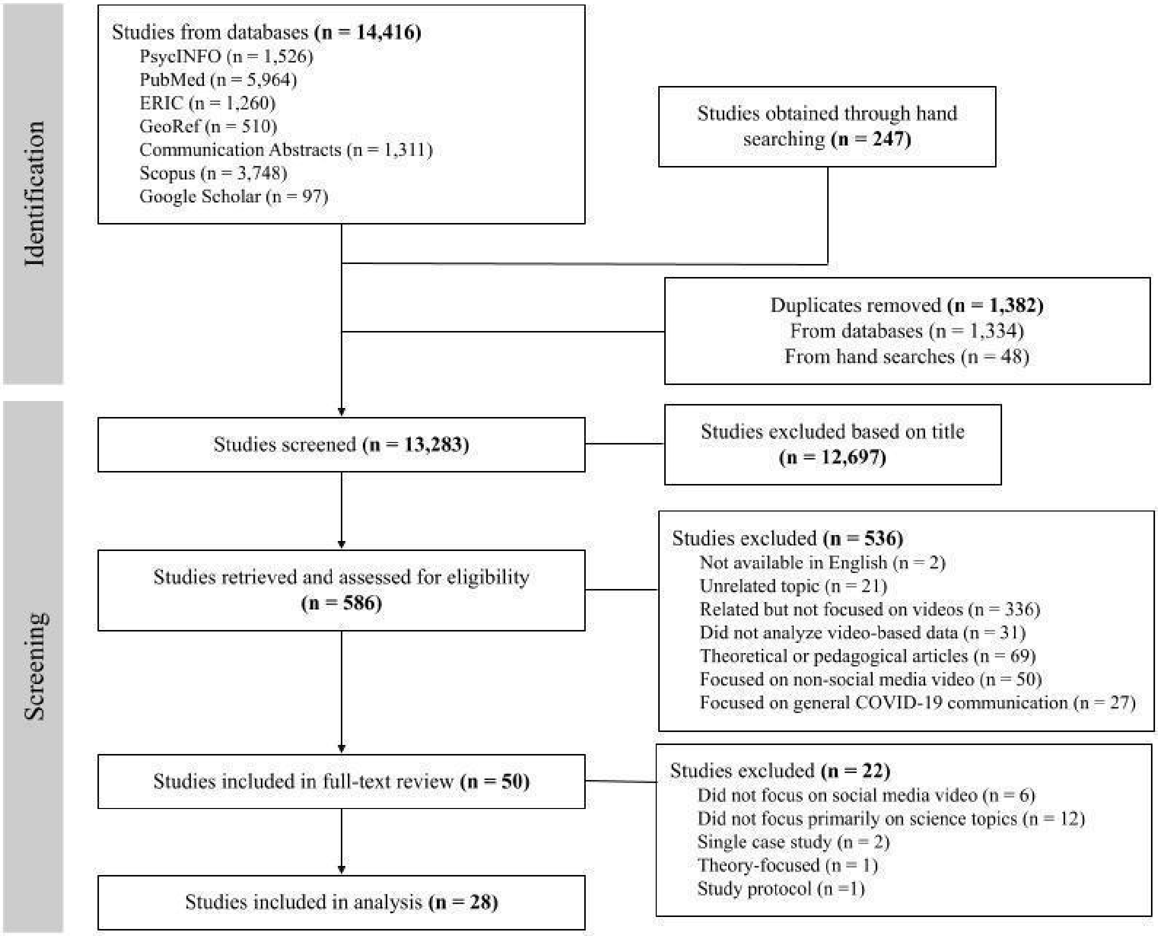

Figure 1. Study selection CONSORT diagram.

Phase 2 analyzed study characteristics to report on the state of research knowledge on science communication via video-based platforms. Between January 2016 and July 2023, 28 articles meeting the study criteria were published across 18 journals (Table 1). Most studies (n = 25, 89.3%) were completed by researchers in the United States.

The 28 articles in this study varied with regard to topics of focus, platforms examined, and methodology. Specifically, nine scientific topics were represented across the studies (Table 2). The most frequent topics included climate change (n = 7, 25%), biology (n = 4, 14.3%), and COVID-19 and public health (n = 3, 10.7%). Seven studies did not target a specific science topic. Instead, they examined science videos generally.

Studies focused on 6 different social media platforms (Table 3). The majority of articles focused on YouTube (n = 13, 42.9%) and TikTok (n = 9, 28.6%). Three studies [Davis et al., 2020, 2022; Ruzi et al., 2021] did not directly involve a social media platform (i.e., independently created video samples).

All studies included video data, with video sample sizes ranging from 1 to 441 (Figure 2). Of the 17 studies that included information about video length, video time ranged from 9 seconds to 6 minutes and 33 seconds. One article [Velho et al., 2020] included documentary-length videos in the sample, but most videos fell under 10 minutes.

Table 1. Number of studies from journals.

Journal name	*Studies* (N = 28)	*Citations*
Public Understanding of Science	4	Davis et al. [2020]; Djerf-Pierre and Lindgren [2021]; Welbourne and Grant [2016]; Yeo et al. [2020]
Environmental Communication	3	Huber et al. [2022]; Shriver-Rice et al. [2022]; Yuan and Lu [2023]
PLoS ONE	3	Habibi and Salim [2021]; Ruzi et al. [2021]; Yang et al. [2022]
English for Specific Purposes	2	Xia [2023a]; Xia [2023b]
Frontiers in Communication	2	Huang and Grant [2020]; Velho et al. [2020]
Journal of Science Communication	2	Finkler and León [2019]; Muñoz Morcillo et al. [2016]
Geoscience Communication	1	Zawacki et al. [2022]
Health Educational Research	1	Li, Guan et al. [2021]
Ibérica	1	Luzón Marco [2019]
International Journal of Communication	1	Zeng et al. [2021]
International Journal of Environmental Research and Public Health	1	Zhu et al. [2020]
International Journal of Science Education	1	Finkler et al. [2019]
JMIR Public Health and Surveillance	1	Basch et al. [2021]
Journal of Community Health	1	Basch et al. [2022]
Journal of Sociology	1	Southerton and Clark [2023]
Science Communication	1	Oh et al. [2020]
Sustainability	1	Davis et al. [2022]
Media and Communication	1	Reif et al. [2020]

Table 2. Scientific focus of articles.

Scientific topics	*n* (%)
Climate Change/Sustainability	7 (25.0%)
Multiple Topics	7 (25.0%)
Biology	4 (14.3%)
Public Health/COVID-19	3 (10.7%)
Marine Science	2 (7.1%)
Physics	2 (7.1%)
Chemistry	1 (3.6%)
Geoscience	1 (3.6%)
Medicine/Health	1 (3.6%)

Note. Percentages calculated based on N = 28 studies included in this review.

Studies used quantitative (n = 9), qualitative (n = 11), and mixed-methods approaches (n = 8). Qualitative studies used multimodal perspectives, media analysis, digital ethnography, and content coding, providing in-depth insights into video content and communication strategies. Quantitative approaches leveraged video analytics, used survey data, and engaged in controlled experiments, offering insight into engagement, viewership, and behavioral intentions. Of the nine studies that included participant data, the sample size ranged from

Table 3. Social media platforms examined.

Social media types	*n* (%)
YouTube	12 (42.9%)
TikTok	8 (28.6%)
Unspecified	3 (10.7%)
TED Talk	2 (7.1%)
Instagram and TikTok	1 (3.6%)
Google Videos, YouTube and Vimeo	1 (3.6%)
Vimeo	1 (3.6%)

Note. Percentages calculated based on N = 28 studies included in this review.

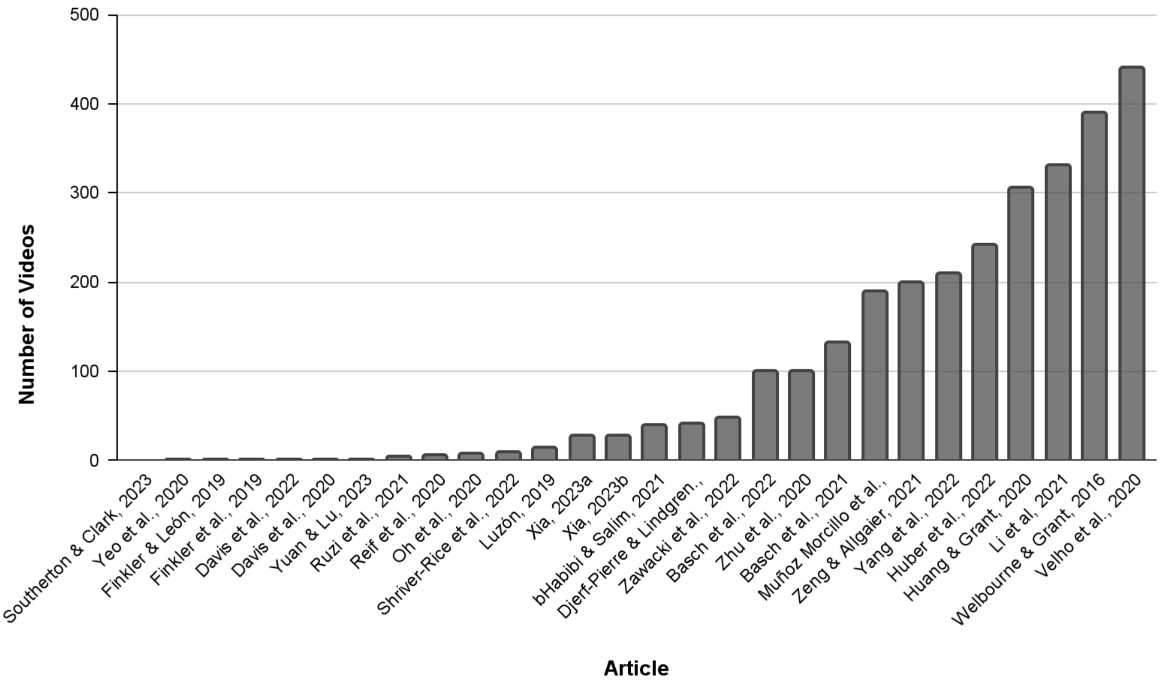

Figure 2. Breakdown of the number of videos examined by article.
Note. This figure demonstrates the number of videos examined based on N = 28 studies included in this review.
[1] Southerton and Clark [2023] did not indicate the number of videos. The sample was curated through 30–60-minute weekly observations on the TikTok app.
[2] Habibi and Salim [2021] included 40 TikTok videos as well as 20 unspecified Instagram photos and videos.

76 to 870 participants, aged between 18 and 87 years old. Several studies adopted mixed methods, combining qualitative depth with quantitative metrics to provide a comprehensive understanding of science communication dynamics on platforms like TikTok, YouTube, and Instagram.

In Phase 3, studies were critically appraised to assess the risk of bias using the seven-question screening process outlined above. Table 4 provides an overview of studies organized by quality rating.

Table 4. Risk of bias assessment: study quality overview.

Quality rating	*Quality score*	*Portion of studies n (% out of total N = 28)*	*Study citation (author, year of publication)*
0	Strong	6 (21.4%)	Davis et al. [2020]; Davis et al. [2022]; Djerf-Pierre and Lindgren [2021]; Muñoz Morcillo et al. [2016]; Huang and Grant [2020]; Reif et al. [2020]
1	Strong	12 (42.9%)	Basch et al. [2022]; Finkler and León [2019]; Finkler et al. [2019]; Huber et al. [2022]; Li, Guan et al. [2021]; Oh et al. [2020]; Ruzi et al. [2021]; Shriver-Rice et al. [2022]; Xia [2023b]; Yang et al. [2022]; Zawacki et al. [2022]; Zeng et al. [2021]
2	Strong	3 (10.7%)	Velho et al. [2020]; Welbourne and Grant [2016]; Yeo et al. [2020]
3	Moderate	5 (17.9%)	Basch et al. [2021]; Habibi and Salim [2021]; Luzón Marco [2019]; Xia [2023a]; Yuan and Lu [2023]
4	Moderate	2 (7.1%)	Southerton and Clark [2023]; Zhu et al. [2020]
5	Weak	0 (0%)	–

Note. Percentage of studies calculated based on N = 28. Quality scores are based on the number of 'no' and 'unclear' responses to screening questions for a risk of bias assessment.

Most studies included in this review (n = 21, 75%) were categorized as "Strong". Studies that received this rating presented clear research questions, had clearly defined variables of interest, used relevant and credible data, had evidence of minimal bias in their sampling strategy, included multiple coders if applicable, effectively articulated their results, and provided clear implications of findings. For example, Huang and Grant [2020] evaluated whether there were differences in storytelling factors in the most versus least viewed science videos on YouTube. They outlined how they selected and analyzed the 306 videos in their sample and made their data corpus available upon request. Their results directly aligned with their research questions and provided clear applications to science communication practices.

A minority of studies included in this review (n = 7, 25%) were classified as "Moderate". These studies provided insufficient or unclear data on up to four screening questions in the appraisal process. For example, it was unclear whether there was a bias in the sampling strategy used by Huber et al. [2022] given that their sample included videos from one collaborative TikTok account that posts videos from multiple users (@eco_tok). Huber and colleagues noted this limitation in the manuscript. No studies were assigned a quality rating of "Weak".

4 ▪ Qualitative analysis of best practices

Across articles, five themes emerged on best practices for effective science communication. Below, we describe these themes (i.e., narrative structure; emotion and connection; video features; professionalism and quality; social media strategies) and highlight actionable strategies and examples. Table 5 includes example videos that demonstrate each theme.

Table 5. Qualitative analysis of best practices: example videos.

Narrative Structure	
Use a hook to engage audiences	YouTube: "What if You Swallowed the Most Venomous Snake Ever?" Channel: Meet Arnold https://www.youtube.com/watch?v=3RvjaNLi1hM
Link content to current events or trends	TikTok: "The seismic power of a Taylor Swift concert!" Channel: @Terraexplore https://www.tiktok.com/@terraexplore/video/7261004310811626798
Establish authority in an accessible way	Tiktok: "TLDR: KEEP FOLLOWING YOUR LOCAL RECYCLING GUIDELINES" Channel: @thegarbagequeen https://www.tiktok.com/@thegarbagequeen/video/7277644226383482158
Encourage critical thinking and engagement	YouTube: "Wilderness: an immersive 360° journey into Patagonia" Channel: The Guardian https://www.youtube.com/watch?v=qVg0iruZUGs
Include a call to action	YouTube: "Tidal Flooding and Sea Level Rise: The Growing Impacts of Global Warming" Channel: Union of Concerned Scientists https://www.youtube.com/watch?v=G-fZnlR_IJ0
Emotion and Connection	
Effective language choices	TikTok: "some people really need to hear this" Channel: @asapscience https://www.tiktok.com/@asapscience/video/7260579440386788613
Carefully consider emotional valence	YouTube: "Tierney Thys: Swim with giant sunfish in the open ocean" Channel: TED https://www.youtube.com/watch?v=Vld1zXGtZGg
Convey authenticity	YouTube: "Why Are Mosquitoes So Obsessed with Me?" Channel: Reactions (American Chemical Society) https://www.youtube.com/watch?v=VYUug72GWB0
Video Features	
Have a consistent speaker	TikTok: "Heating coffee using thermite!" Channel: @chemteacherphil https://www.tiktok.com/@chemteacherphil/video/7196691976278805806
Prioritize entertainment	YouTube: "Do You Hear "Yanny" or "Laurel"? (SOLVED with SCIENCE)" Channel: AsapSCIENCE https://www.youtube.com/watch?v=yDiXQl7grPQ
Focus on fast paced, shorter videos	TikTok: "There's not just earthquakes, there's also moonquakes and marsquakes!" Channel: @terraexplore https://www.tiktok.com/@terraexplore/video/7229758346608315690
Professionalism and Quality	
Invest time in production and editing	YouTube: "Brainwaves in motion: A wearable brain scanner" Channel: nature video https://www.youtube.com/watch?v=7kkeQtG6ppA
Consider increasing visual complexity	YouTube: "Fracking explained: opportunity or danger" Channel: Kurzgesagt — In a Nutshell https://www.youtube.com/watch?v=Uti2niW2BRA
Prioritize visual connections with the speaker	TikTok: "oysters can save (& clean) the ocean" Channel: @carissaandclimate https://www.tiktok.com/@carissaandclimate/video/7283572867785346350

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Social Media Strategies	
Use social proof	TikTok:"OMG, Gyno content from @trixiemattel and @Katya Zamolodchikova" Channel: @karentangmd https://www.tiktok.com/@karentangmd/video/7294394549936426282
Study what is trending on your platform	TikTok: "Transparent Cans — Part 2" Channel: @coolchemistryguy https://www.tiktok.com/@coolchemistryguy/video/6865435851107650822
Use platform-specific features	TikTok:"Fact check: do we bleed into our abdomens with periods??" Channel: @dr.staci.t https://www.tiktok.com/@dr.staci.t/video/7190479323516751146
Understand the culture of your target audience	TikTok: "Turning my house into an urban farm!" Channel: @nickuhas https://www.tiktok.com/@nickuhas/video/7122912323928411434

4.1 ▪ *Narrative structure*

Strong narrative structures that incorporated plot and storytelling elements were associated with greater reach for science communication videos. For instance, narrative-style stories about climate change, rather than informational accounts, were more impactful in encouraging pro-environmental behaviors [Morris et al., 2019]. Videos with a plot and suspense generally attracted more views [Muñoz Morcillo et al., 2016]. Popular videos were more likely to incorporate at least one moment of change in the narration [Huang & Grant, 2020]. To implement a strong narrative structure, consider implementing the following elements in this order.

Use a hook to engage audiences. Catchy introductions capture public attention and make content more relatable. For instance, starting with a thought-provoking question or statement can pique curiosity or connect to people's everyday lives. To illustrate, one video's hook posed the question: "What happens when an immovable object meets an unstoppable force?" [Minutephysics, 2013]. This hook introduces the subject and generates curiosity [Muñoz Morcillo et al., 2016]. Huang and Grant [2020] found that 70% of the top videos in their sample had a question as the title (e.g., "World's Largest Jello Pool — Can you swim in Jello?", "What if You Swallowed the Most Venomous Snake Ever?"). These types of hooks are effective because they place key information up front, what Davis et al. [2020] call "climax first" [p. 698]. Videos that clearly articulate their content receive more views [Huang & Grant, 2020]. Other potential hooks include linking content to current events, using a dramatic start, or referencing popular trends or music [Muñoz Morcillo et al., 2016; Yang et al., 2022].

Establish authority in an accessible way. To establish credibility, scientists used a variety of methods, including wearing lab coats or stating an affiliation [Huber et al., 2022; Zeng et al., 2021]. It is also possible to establish credibility using data graphics, clear scientific explanations, or experiments [Huber et al., 2022; Reif et al., 2020; Shriver-Rice et al., 2022; Yang et al., 2022]. When possible, discussing your own scientific work is effective [Ruzi et al., 2021]. Establishing expertise matters for trustworthiness, yet this must be balanced with accessibility [Reif et al., 2020]. For instance, pairing technical visuals with approachable verbal explanations can aid comprehension [Xia, 2023a; Luzón Marco, 2019], as can employing multiple communication methods such as subtitles, visuals, and verbal explanations. Notably, videos with subtitles had more views and shares [Li, Guan et al., 2021; Zhu et al., 2020].

Encourage critical thinking and engagement. Critical thinking and reflection on source credibility matters [Southerton & Clark, 2023]. Discussing research implications and future work creates a more democratic and interactional mode of communication [Xia, 2023b; Muñoz Morcillo et al., 2016]. Further, demonstrations lead to increased user engagement [Habibi & Salim, 2021], likely because they allow viewers to pose questions and draw conclusions. For instance, creator @carissaandclimate has a video advocating for ocean conservation. In her video, she demonstrates how to restore an oyster bed [Cabrera, 2023]. Viewers may wonder about the difficulty of restoration yet the video demonstration reveals that the restoration is fairly easy [Huber et al., 2022]. Scientists need not focus solely on narrative elements to engage viewers. Visual elements (mise-en-scene, cinematography, editing, sound) may create a more compelling and engaging narrative [Finkler et al., 2019]. For instance, The Guardian has a video on Patagonia that starts with silence and a black screen [Oh et al., 2020; The Guardian, 2018], creating cinematic suspense.

Include a call to action. Guide the audience on what actions can be taken after watching the video [Djerf-Pierre & Lindgren, 2021; Shriver-Rice et al., 2022]. The Union of Concerned Scientists has a YouTube video that lists this call to action: reduce carbon emissions to mitigate climate change [Shriver-Rice et al., 2022; Union of Concerned Scientists, 2014].

4.2 ▪ *Emotion and connection*

Effective language choices. Language plays a crucial role in emotionally engaging viewers and enhancing the persuasiveness of arguments [Luzón Marco, 2019]. By conveying intimacy, informality, or affinity, communicators can establish a deeper connection with their audience. Further, communicators foster connection when they address the audience directly and use examples from people's lives [Muñoz Morcillo et al., 2016; Shriver-Rice et al., 2022]. For example, in a video discussing sound waves, creator @terraexplore utilized visuals from a Taylor Swift concert to illustrate the concept, effectively bridging the gap between abstract scientific concepts and real-life experiences [Zawacki et al., 2022; Terra Explore, 2023c]. Further, consider the implications of the science and make connections to other fields of study. The most popular YouTube science videos are those with interdisciplinary themes. For instance, one of the most watched videos on the YouTube channel, "Feed the Brain" intertwines philosophy, history, psychology, and neuroscience fields [Velho et al., 2020].

Carefully consider emotional valence. Huang and Grant [2020] found that evoking higher-arousal emotions (anger, fear, anxiety, excitement, and awe) was associated with more views when compared to videos that focused on lower-arousal emotions (sadness, calmness, and boredom). Li, Guan et al. [2021] found that using the emotions of alarm or concern increased user engagement with videos by increasing comments. Yet, evoking negative emotions, such as guilt, may decrease future audience engagement [Huber et al., 2022]. For instance, it is recommended that speakers avoid attributing environmental problems to individuals' responsibilities in short videos. In addition, overly emotional music should be avoided [Shriver-Rice et al., 2022]. To illustrate, aggressive climate change videos that violate audience expectations can reduce audience willingness to perform pro-environmental behaviors [Yuan & Lu, 2023]. Conversely, using humor in videos can increase likeability and engagement [Basch et al., 2021; Yeo et al., 2020]. For instance, scientist Dr. Tierney Thys's

TEDTalk on jellyfish included humorous images of animals to elicit laughter [TED, 2007; Xia, 2023a].

Convey authenticity. Speaker authenticity influences audience perception and engagement. Shriver-Rice and colleagues [2022] emphasized the significance of communicating authentically, underscoring its association with videos being perceived as "truthful". Yang and colleagues [2022] also emphasized the importance of striking a balance between garnering social engagement and authenticity. To illustrate, in a video included in Yang and colleagues [2022]'s sample entitled "Why are Mosquitos So Obsessed with Me?" on the American Chemical Society's YouTube channel, the speaker adopted a conversational tone, drawing the audience in with personal anecdotes about her own experiences with mosquitoes [Reactions, 2023]. By also incorporating humor throughout the dialogue, the speaker further established a genuine connection with the audience, fostering a deeper connection with the video content.

4.3 ▪ *Video features*

Have a consistent speaker. Channels with a consistent speaker, such as one or two scientists who were prominently featured in a majority of the videos produced, were more popular than channels without such consistency [Welbourne & Grant, 2016]. Also, individual users were more influential than organizations or aggregator accounts [Welbourne & Grant, 2016; Zeng et al., 2021]. For example, Zeng et al. [2021] identified one of the popular TikTok accounts in their dataset, chemistry teacher Phil Cook (@chemteacherphil), who regularly posts himself demonstrating lab experiments. A single speaker who demonstrates consistency and individuality helps develop rapport with the audience.

Prioritize entertainment. Entertainment was a better predictor of video success, surpassing both production quality and technical complexity [Muñoz Morcillo et al., 2016]. Strategies to prioritize entertainment involve incorporating elements such as dance, parodies, "edutainment", and memes. Videos featuring dance may increase the number of shares and help connect with younger generations [Li, Guan et al., 2021; Ruzi et al., 2021]. Li, Guan et al. [2021] found that TikTok dance videos contained more rhythmic music and mimicable body movements in comparison to other types of videos, which may have contributed to more shares and interactions.

Focus on fast-paced, shorter videos. Videos that delivered information at a quicker pace had more views than slow-paced ones [Welbourne & Grant, 2016]. Additionally, shorter videos outperformed longer ones [Finkler & León, 2019; Zawacki et al., 2022; Zhu et al., 2020]. However, the best length of the video may vary based on video type and platform. Lecture-style TikTok videos perform best at around one minute, while demonstration-style TikTok videos may be most effective at thirty seconds [Zawacki et al., 2022]. For example, an educational video on moonquakes and marsquakes by @terraexplore outperformed others due to its concise format lasting about one minute [Terra Explore, 2023a]. Similarly, @terraexplore surpassed similar educational videos with a 30-second demonstration of a seismology experiment [Terra Explore, 2023b]. The concise, step-by-step demonstration utilized visuals and real-life examples to sustain the audience's attention [Zawacki et al., 2022]. Optimal video lengths were indicated by audience viewing duration as well as engagement of likes, comments, and shares [Zawacki et al., 2022].

4.4 ▪ *Professionalism and quality*

Invest time in production and editing. As Xia [2023b] noted: "while scientists perform as onstage popularizers, the post-production team tends to create the visual language of science through video communication" [p. 73]. Ways to increase the quality of a video include adjusting white balance, using studio lights, special effects, or even less technical strategies such as using a tripod to create a stable recording [Muñoz Morcillo et al., 2016]. Scientists would benefit from collaborating with professional science communicators to increase the quality of their content.

Consider increasing visual complexity. Leveraging diverse visual formats, from raw photographs (e.g., photos of biological phenomena, equipment used in the lab) and artistic interpretations to data-driven graphics and animations, can increase audience's understanding and engagement [Xia, 2023a]. Cartoons, especially when discussing a complex/medical topic, were associated with more views [Zhu et al., 2020]. Cartoon-style animations may be particularly useful for connecting to younger audiences [Djerf-Pierre & Lindgren, 2021].

Prioritize visual connections with the speaker. For instance, a green screen increases the viewer's connection by allowing the audience to see the speaker and an image [Zawacki et al., 2022]. As another example, vlog and group conversation formats were associated with higher video popularity [Velho et al., 2020].

4.5 ▪ *Social media strategies*

Scientists can strategically use social media to increase the reach of their communication efforts, as outlined below.

Use social proof. Social proof refers to the idea that people look to others for information about how to behave [Shearman & Yoo, 2007]. With regard to video communication, for example, higher numbers of likes and higher channel productivity predict higher video popularity [Velho et al., 2020]. The number of likes serves as tangible evidence to viewers that the content is valued and worth engaging with. To leverage social proof, consider engaging with regionally admired influencers [Zhu et al., 2020]. Influencer engagement is social proof that followers may also want to consider engaging with you.

Study what is trending on your platform. Evaluate the videos and replicate those qualities [Zawacki et al., 2022]. Similarly, evaluate popular hashtags. A higher number of hashtags was related to higher video likes [Li, Guan et al., 2021]. Select hashtags relevant to the video topic, especially ones including locations, to provide additional algorithmic video context [Basch et al., 2022; Zawacki et al., 2022].

Use platform-specific features. Utilizing platform-specific features can facilitate dialogue and engagement. For instance, TikTok has video replies, stitches, duets, green screen, and image overlay options [Southerton & Clark, 2023; Zawacki et al., 2022].

Understand the culture of your target audience. Know your audience and consider how you may be perceived. This knowledge can aid in determining which types of narrative approaches may be most appropriate. Within a European context, researchers found that engaging with a younger generation might best be accomplished with vernacular language and styles that promote engagement such as science parodies, “edutainment”, and memes [Zeng et al., 2021]. Within a Chinese context, researchers found that the most followed content used formal Mandarin language [Zhu et al., 2020]. Males with a university education are likely to be the most skeptical and hardest to please [Davis et al., 2022]. For those less engaged with science, using an infotainment version of the narration may be more effective [Davis et al., 2020]. Finally, viewers may deem younger scientists to be less typical and therefore less trustworthy [Reif et al., 2020], making establishing credibility quickly a priority.

5 ▪ Discussion

This study aimed to evaluate the state of knowledge on science communication via video-based platforms and provide guidance on effective strategies for video science communication. We completed a scoping review of the literature and identified 28 articles on this topic published between January 2013 and June 2023. Below, we discuss our key findings.

Our quantitative analysis highlights several issues and potential future directions. Topics like climate change and biology were frequently examined in the reviewed articles, suggesting that these areas may receive more support and resources for video communication. Other scientific disciplines might encounter challenges in adopting video-based communication strategies. This observation raises questions about the incentives and barriers involved in using video for science communication. Understanding these factors is crucial for developing comprehensive training programs for scientists.

There is limited information on the best methods to train scientists in video communication, highlighting the need for this scoping review. The insights gained from our study can support the training of graduate students in these essential skills. Additionally, grant funders have highlighted dissemination as a critical priority, emphasizing the importance of sharing scientific knowledge widely [NIH Office of Disease Prevention, n.d.]. However, it remains unclear whether accreditation processes for STEM programs consistently assess or include technical communication skills training for students. For instance, while the main accreditation body for engineering programs in the United States, the Accreditation Board for Engineering and Technology, does not publicly disclose its accreditation criteria, it evaluates programs based on their ability to equip graduates with essential professional skills [ABET, n.d.]. Integrating dissemination competencies into graduate programs could foster effective communication skills across scientific disciplines

Our qualitative analysis surfaced five themes across the literature for effective science communication via video: narrative structure, emotion and connection, video features, professionalism and quality, and social media strategies. Importantly, across the literature, studies highlighted actionable strategies that scientists may use to strengthen their video communication efforts. Of import, these strategies were platform agnostic, meaning they could be employed across any platform a scientist chooses.

Many scientists may feel ill-equipped to independently produce videos for public science communication [McNeal et al., 2021]. However researchers may not need to take on video production themselves. Rather, awareness among scientists of the unique engagement potential and communicative strengths of video can support collaboration with professional science communicators. For instance, McNeal et al. [2021] emphasize that a collaborative approach allows scientists to contribute their expertise while leveraging the skills of trained communicators to create engaging, accessible content that resonates with public audiences. By identifying key features of effective science videos, our review provides insights and evidence-based guidelines that scientists and communication professionals can use together to improve public engagement with science.

Future studies are needed to specifically evaluate how video and creator characteristics impact video popularity and reach. For example, Li, Tian et al. [2021] investigated the influence of content and creator characteristics on the effectiveness of sharing disaster-related information on the Chinese social media platform Weibo. They found that both the geolocation (creators closer to the location) and the social capital of creators (more followers) increased post virality. In addition, user demographics and social identities impact perceptions of trustworthiness and willingness to interact with creators. For example, Jarreau et al. [2019] found that gender was a major driver of changes in stereotypes of scientists' warmth. Seeing a series of female scientist selfies on Instagram shifted stereotypes that associate STEM fields with being male, as well as positively shifted stereotypes about scientists' warmth. This is important, as perceptions of warmth are associated with increased trustworthiness. People are more likely to pay attention and act upon information from trustworthy sources [Höttecke & Allchin, 2020]. Furthermore, a valuable direction for future research is to examine the impact of the video producer — such as individual scientists, professional communicators, or scientific organizations — on video effectiveness and audience engagement. Differences in platform (e.g., TikTok vs. YouTube) and production style may also affect the accessibility and credibility of science content, offering a more nuanced understanding of best practices in video-based science communication.

5.1 ▪ *Limitations*

While this review provided a comprehensive overview of the state of knowledge on science communication via video-based platforms, several limitations should be acknowledged. As noted, the search focused on peer-reviewed journal articles published in English with data collected in English-speaking countries, thus limiting the scope. In addition, the review examined studies published within the past decade, which may have excluded relevant older studies or failed to capture relevant articles published after this timeframe. Given the rapidly evolving nature of social media platforms and science communication practices, newer studies may provide additional insights. To illustrate, Nguyen and Diederich [2023] published a study identifying key patterns of knowledge construction on TikTok after our study's database cutoff. In addition, social media platforms are continuously evolving, with frequent updates, algorithm changes, and emerging features. While this study provides actionable strategies for effective science communication via video, it cannot anticipate all changes to social platforms. The rapid pace of platform evolution may influence the effectiveness of certain strategies over time, necessitating ongoing adaptation and experimentation. Future research should strive to incorporate both non-peer-reviewed studies and articles published in diverse languages. Despite these limitations, our risk of bias analysis revealed that the majority (75%) of studies fell into the "Strong" category, with none categorized as "Weak", indicating the established nature of this topic within the literature and suggesting a robust foundation for further investigation and analysis.

6 · Conclusions

Our findings highlight the increasing adoption of video-based communication by scientists across disciplines, with opportunities for expanded training to enhance both reach and effectiveness. Although not expecting all scientists to become filmmakers, this review helps scientists understand the essential components of effective video communication, as well as recognize the value of accessible, well-supported video communication training programs that equip scientists to collaborate with professional communicators. This approach can encourage participation from scientists of diverse backgrounds, helping to broaden public perceptions of who can be a scientist and inspiring a broader spectrum of individuals to pursue careers in STEM fields [Chambers, 1983; Canfield et al., 2020; González-Pérez et al., 2020]. In addition to investigating how video and creator characteristics impact video popularity and reach, future research could examine incentives and support structures that foster scientists' interest and engagement in video-based outreach, addressing any barriers they may encounter and identifying ways to make science communication skills more attainable and impactful.

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About the authors

Betty S. Lai (she/her) is an Associate Professor in the Department of Counseling, Developmental, and Educational Psychology at Boston College. Dr. Lai's research focuses on the effects of the climate crisis and large-scale natural disasters on children's psychological trauma responses and health behavior outcomes. Lai is the author of *The Grant Writing Guide: a Road Map for Scholars* (Princeton University Press) and the forthcoming book, *The Public Scholar* (Princeton University Press).

betty.lai@bc.edu

Alexa Riobueno-Naylor (she/her) is a doctoral candidate in Counseling Psychology at Boston College. Alexa is a clinician-researcher dedicated to providing culturally-informed, evidence-based, and accessible prevention and intervention efforts for children, adolescents, and families. Her dissertation research focuses on the relationship between multiple disaster exposure and youth mental health.

riobueno@bc.edu

Sarah Quan (she/her) is an undergraduate student pursuing a BA in Applied Psychology and Human Development as well as a double minor in Global Public Health and the Common

Good, and Studio Art. Her research interests focus around understanding socio-emotional health psychology and promoting positive adolescent developmental identities among marginalized communities. Sarah hopes to contribute toward combating racial and ethnic disparities through public health initiatives.

quansa@bc.edu

Mauricio Montes (he/him) is a doctoral candidate in Counseling Psychology at Boston College. He is a National Science Foundation Graduate Research Fellow. Mauricio's clinical work and research center on applying intersectional approaches to better understand trauma exposure, symptomatology, and recovery. His dissertation explores the impacts of intersectional microagressions on LGB+ Latine mental health.

mauricio.montes@bc.edu

Jon Wargo (he/him) is an Associate Professor at Marsal Family School of Education at the University of Michigan. Wargo's work centers around the role of media and the intersection of youths' critical learning literacy. He focuses on understanding the heterogeneity within human sensemaking, teacher education, inquiry methodologies and social change. Wargo was awarded the Early Career Achievement Award by the National Council of Teachers of English Children's Literature Assembly and the NCTE Media Literary Award.

wargojon@umich.edu

Mo Jones-Jang (he/him) is an associate professor in the Department of Communication at Boston College. His research focuses on science communication, digital information behavior, big data analytics, and media psychology. He is specifically interested in misinformation behavior within the post-truth era and redesigning science communication strategies to prevent distrust. He has served as an editorial board member for the *Journal of Communication* and *Science Communication*.

mo7788@gmail.com

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