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How epidemiologists exploit the emerging genres of twitter for public engagement

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ARTICLE INFO

Article history:
Available online 25 November 2022

Keywords:
Digital genres
Emerging academic genres
Public science
Genre analysis

ABSTRACT

With the COVID–19 global pandemic, epidemiologists and other public health professionals have become important sources of insight for the general public. One popular means for reaching public audiences is the microblog Twitter. Understanding how prominent professionals tweet—and what might contribute to the visibility or reach of their tweets—can reveal insights into the emerging digital genres scientists use for communicating across specialist and non-specialist domains. Toward that aim, this study examines the use of Twitter by ten epidemiologists during a one-month period in 2020, focusing specifically on those with a strong following on the platform. The research analyzes 143 high- and low-engagement tweets in several genre-related areas: tweet types and elements; tweet topics, purposes, and audiences; and author identities. The study demonstrates that “tweeting science” involves the use of a range of emerging Twitter genres and identities that together engage diverse audiences for purposes. The paper also discusses the implications of this research for genre theory and ESP instruction.

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1. Introduction

With the COVID–19 global pandemic, epidemiologists and other public health professionals have become important sources of insight in news stories in print, on the web, and on radio and television. Many have also enjoyed a substantial rise in their social media following. Given the popularity and wide reach of social media, these platforms can play a unique role in educating the public about science-related concerns and in carrying out a larger goal of democratizing science (Luzón & Pérez-Llantada, 2019). Even before the pandemic, Twitter emerged as one of the key social media platforms for scientists wanting to communicate with broader public audiences. Through its digital mediation, Twitter offers scientists not just an “inreach” tool for communicating with disciplinary peers but also a crucial outreach tool for influencing the media, the public, and high-level decision-makers (Côté & Darling, 2018).

Scholarship has begun to examine scientists’ and other academics’ use of Twitter for communication of professional and scientific content (e.g., Graham, 2020, 2021; Luzón & Albero-Posac, 2020; Myers, 2015). Such research provides insight into the function and form of scientists’ tweets, though less attention has been given to audience engagement and to qualitative analysis of scientists’ identity performances on the platform. Understanding how prominent professionals tweet—and what might contribute to the visibility or reach of their tweets—can reveal insights into the emerging digital genres scientists use for communicating across specialist and non-specialist domains. Toward that aim, this study examines the use of Twitter by public health specialists during the pandemic, focusing specifically on those with a strong following on the social media

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https://doi.org/10.1016/j.esp.2022.10.005
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platform. Unlike the research genres that scientists typically use to share their work, genres on social media can reach multiple audiences while allowing for new means for communicating and constructing a range of identities with interested readers. To understand how scientists utilize these affordances, this study explores genre features of their high- and low-engagement tweets and considers how they perform identities within and across tweet genres.

The paper begins by reviewing research related to the public communication of science, digital mediation, and the use of Twitter by academic researchers. It then shares research on the use of Twitter by ten prominent public health specialists during a one-month period in 2020. Finally, I consider implications of this research for genre theory and ESP instruction and recommend further avenues of study.

2. Public communication of science, digital mediation, and twitter

As the world faces the daunting threats of climate change and the more immediate challenge of the COVID-19 pandemic, the need for public communication of science has perhaps never been greater. Calls for an increase in open science—“transparent and accessible knowledge that is shared and developed through collaborative networks” (Vicente-Saez & Martinez-Fuentes, 2018, p. 434)—are pervasive. Many citizens crave an understanding of the crises we face, and scientists and policy-makers see the urgency of communicating complex and specialized information in ways that are meaningful and engaging to a broad public—particularly as the spread of misinformation grows. This increased need for open, accessible science and public information coincides with the rise in digital mediation of communication and the emergence of new digital genres. Content is now shared with wide audiences through blogs, videos, infographics, podcasts, and social media posts. These channels of communication open up new possibilities for writers. With short histories, lower stakes, and less formalized gatekeeping, new digital genres generally allow for more flexibility and innovation than most print-based academic genres (Tardy, 2016). Further, the digital medium allows writers to utilize a wider range of semiotic resources, including (and often integrating) visuals, audio, gestures, hyperlinks, and writing, so that information can be communicated in new—and often more accessible—ways. The genres that have emerged in this new digital medium may differ rhetorically from print-based genres as well. Zou and Hyland (2022) describe academic blogs and three minute theses (3MT®), for example, as “genres where visibility and rivalry predominate, having replaced more virtuous values of modesty and cooperation” (p. 4). Thus, the digital mediation of scientific information may allow, or even oblige, writers to engage with their readers in new ways.

Additionally, the wider accessibility of many digital genres results in what is often referred to as “context collapse” (Marwick & boyd, 2011a), in which boundaries between contexts and audiences are eroded. Writers no longer can assume their audience will simply be other specialists or only non-specialists; instead, they must assume a range of audiences will access and engage with their texts, perhaps in different ways. As a result, the use of these new digital forms requires an awareness of how the merging of contexts and audiences shapes the text itself (Pérez-Llantada, 2021).

Context collapse is especially prominent in social media, with its emphasis on networks, engagement, and reach. One social media type that stands out in science communication is microblogs: websites or apps that display short posts that can be liked, shared, or replied to by large numbers of people. The most popular microblogging site in English is Twitter; data suggest that 22% of Americans have used Twitter at some point in time (Perrin & Anderson, 2019), but the site is also used globally and in numerous languages. Twitter’s platform is relatively simple. Users adopt a display name and a username (@) and create a short profile. They can compose public or private posts (“tweets”) of up to 280 characters, and they may follow any number of other users. Tweets are viewed by followers and, if public, are easily visible to non-followers. Users can engage with tweets by “liking” them, “retweeting” (sharing) them, and replying to them. Tweets that appear in a user’s “feed” include those by people they follow as well as those liked or shared by those they follow; in this way, tweets can accrue audiences far beyond the author’s immediate followers or even their immediate perception of their audience. Tweets are also often shared on other media platforms, from Facebook to national news. It is this potentially wide reach of tweets that make Twitter especially well suited to the communication of science to broad, public audiences but also complex for writers, whose texts may reach very diverse or even unanticipated contexts and readers.

Used by nearly 40% of scientists (Côté & Darling, 2018), Twitter is increasingly seen as an important channel for networking within research communities. Users can share and promote recent work, live-tweet conference, elicit and give comments on academic issues, and share calls for papers, publications, or job postings. Several studies have explored how academic researchers use Twitter, identifying some of the most common functions. A study of 10 medical doctors’ use of the social media platform found the most common purposes for tweeting were dissemination of information, promoting one’s work, and interacting or engaging with others in their professional community (Tereszkiewicz, 2015). Similarly, a study of communication scholars’ tweets found their largest share of tweets to consist of peer-to-peer communication; the most common tweet topic was science (especially related to research or teaching) and the most common speech act patterns were to discuss, to report, or to comment (Jünger & Fähnrich, 2020). The authors conclude that, for these scholars, Twitter is primarily used as a tool of scholarly communication.

These examples of communication among scientists illustrate Twitter’s function as an “inreach” tool (Côté & Darling, 2018), with tweets circulating primarily among other specialists and perhaps organizations or agencies with related scientific concerns. For a subgroup of scientists, however, Twitter can also serve as an “outreach” tool, reaching members of the media, the general public, and perhaps even policy-makers and government agencies (Côté & Darling, 2018). In their study of scientists on Twitter, Côté & Darling (2018) identified 1,000 followers as a kind of tipping point: scientists with fewer than
1,000 followers tended to be followed mostly by other scientists, whereas those with more than 1,000 were followed mostly by non-scientists. The latter group therefore had more ability to use Twitter for outreach, while the former group generally had a more specialized audience.

Research into scientists’ tweets reflects an awareness of these multiple audiences as well. Studying medical professionals’ microblog activity, Myers (2015) found the writers to regularly use Twitter across four “modes”: personal, professional, institutional, and public. Similarly, Jünger and Fähnrich’s (2020) study of communication scholars on Twitter identified multiple topics: 35% of their tweets were about science, but 25% were about personal topics, 23% about politics, 8% about the economy, and another 8% about the media. These findings suggest a need to de-couple “scientists on Twitter” from #ScienceTwitter and to explore further how scientists navigate the multiple audiences and purposes across their Twitter activity.

According to Marwick and boyd (2011a), this potential for diverse readership on Twitter can pose a challenge to writers, particularly for those with a large following. Without a stable sense of discrete audiences, as often assumed in many academic genres, writers must manage their self-presentation in more complex ways. For example, a tweet intended for disciplinary insiders can also be seen by government agencies and a tweet intended for friends is viewable by professional colleagues and journalists. Users therefore must carefully navigate multiple, overlapping readerships and goals, “strategically concealing information, targeting tweets to different audiences and attempting to portray both an authentic self and an interesting personality” (Marwick & boyd, 2011a, p. 122). In doing so, scientists are likely to take on different roles and perform diverse identities within a single Twitter account.

3. Genre theory and twitter communication

With audience, purpose, and content lying at the heart of the challenges of Twitter communication by scientists, genre theory offers a productive lens for its study. I define genre here as a recognizable category of discourse used to carry out a social action (Miller, 1984) or communicative purpose (Swales, 1990) primarily through language and/or other semiotic resources. Genres become conventionalized through repeated use, resulting in their recognizable (though not static) forms and the expectations of their users. In ESP, genre theory has tended to draw strong connections between genre forms and their communicative purposes and discourse communities (or communities of practice) (Swales, 1990), with each shaping the others.

Previous studies of communicating scientific work to wider audiences have adopted a genre lens to explore blogs (Luzón, 2013; Zou & Hyland, 2022), three minute theses (Hu & Liu, 2018; Zou & Hyland, 2022), “scholarly soundbites” (Rowley-Jolivet & Carter-Thomas, 2019), and research websites (Lorés, 2020). Some common themes in these findings are that in recon-textualizing and remediating scientific discourse, authors attempt to create interest in and accessibility to their work through emphasis on storytelling, connection to public values, reduction of scientific information, and inclusion of personal expression. Often these new genres are marked by hybridity, blending features of academic and personal registers. Many of these themes also highlight the relationship between identity and genre, demonstrating that less formal academic genres allow (perhaps even oblige) writers to construct and perform more diverse identities compared to more traditional academic genres.

Studying scientists’ tweets through genre theory adds to the growing body of research into emerging ways of communicating research. As described previously, one intriguing complexity of digitally mediated communication, such as tweets, is their ambiguous or diverse audiences and purposes. Therefore, exploration of scientists’ tweets has potential to enhance our understanding of emerging, digitally mediated genres with implications for genre theory. Analyses of tweet genres to date have explored, for example, communicative functions and semiotic resources used in conference tweets (Luzón & Albero-Posac, 2020), rhetorical moves in tweets on vaccination reports by the European Center for Disease Control (Orpin, 2019), and rhetorical moves in “literacy support tweetorials” on COVID-19 (Graham, 2020, 2021). These studies show that writers use the linguistic, rhetorical, and multimodal resources available in tweets to engage in social purposes such as community building, recontextualizing science reports, and countering misinformation.

In sum, previous research suggests that scientists may use Twitter predominantly for in-group interaction, but that they do not limit their communications to scientific topics or specialist audiences. Those with larger followings may have even more diverse interactions on the platform, navigating multiple audiences, topics, goals, and roles. Thus, while most discourse-oriented studies have focused on science tweets, there is also a need to understand scientists’ tweets in all of their diversity, hoping to gain insight into how professionals exploit the various ways of interacting on Twitter as they attempt to use it as a tool for outreach with the public.

4. Methodology

This small-scale, exploratory study aims to understand potential impacts on audience engagement with tweets by a subset of public health professionals (epidemiologists) during the COVID-19 pandemic. This group of specialists was chosen because of their prominence in conversations about public health during the pandemic. The study investigates the following research questions:

1. What are some genre characteristics of high- and low-impact tweets by prominent epidemiologists during the COVID-19 pandemic?
2. What identities do prominent epidemiologists perform in their tweets?

Specifically, the study explores and compares high- and low-engagement tweets by epidemiologists who are highly visible on Twitter, examining several genre-related elements: tweet types and multimodal/hypertextual elements; tweet topics, purposes, and audiences; and author identities. I carry out these analyses in a corpus of 143 tweets written by ten scientists with expertise in epidemiology. With this relatively small corpus of texts, my aim is not to identify generalizable trends but rather to offer a more qualitative picture of how some high-impact public health scientists use Twitter.

Because of my interest in scientists’ use of Twitter for public outreach, I began by identifying 10 epidemiologists who had a wide reach on social media. I first turned to websites with directories of epidemiologists or of COVID-19 experts on Twitter (e.g., Brown, 2020; Peikoff, 2020; Society for Epidemiologic Research, n.d.). Drawing from several of these sites, I compiled a list of 24 US-based epidemiologists who had at least 50,000 followers and whose Twitter accounts pre-dated February 2020, when the virus became a concern in the US. I further narrowed these 24 epidemiologists down to 10 by roughly balancing for gender and avoiding any institutional overlap (see Table 1). Many of these 10 scientists regularly interact with the media, frequently being interviewed in radio, TV, and print news. Partly related to (and likely contributing to) their high visibility, many of these scientists are also affiliated with elite institutions; one of the scientists, Ashish Jha, became the White House Covid-19 Response Coordinator in March 2022. In other words, this group of scientists should not be seen as representative of scientists on Twitter; instead, they offer a window into the uses of Twitter by exceptionally visible and well connected scientists who use Twitter as an outreach tool.

| Display Name & Username | On Twitter Since | Followers | Institutional Affiliation |
|-------------------------|-----------------|-----------|--------------------------|
| KizzyPhD @KizzyPhD      | January 2020    | 50.5K     | National Institute of Allergy and Infectious Disease |
| Dr. Ellie Murray @EpiEllie | June 2013     | 60.5K     | Boston University        |
| Prof. Akiko Iwasaki @VirusImmunity | May 2017 | 83K       | Yale University          |
| Dr. Tara C. Smith @aetiology | April 2009   | 90.9K     | Kent State University    |
| Ashish K. Jha, MD, MPH @ashishjha | May 2009 | 113.6K    | Brown University         |
| Carl Bergstrom @CT_Bergstrom | June 2015    | 127.4K    | University of Washington |
| Caitlin Rivers, PhD @cmyeaton | February 2012 | 153.5K    | Johns Hopkins University |
| Faheem Younus, MD @faheemYounus | October 2011 | 173.5K    | University of Maryland   |
| Dr. Angela Rasmussen @angie_rasmussen | October 2011 | 175.2K    | Columbia University      |
| Marc Lipsitch @mlipsitch | September 2009 | 215.3K    | Harvard University       |

* Data were collected on November 2, 2020, and may have since changed.

I collected all tweets for these 10 scientists published between October 1 and 31, 2020, resulting in a total of 868 tweets. This time period coincided with the start of a “third wave” of the virus in the US, a surge which peaked in January of 2021. October 2020 was also noteworthy for the political climate, as it was the last month before the US presidential election (held on November 3, 2020) and because then-President Donald Trump was diagnosed with COVID-19 on October 2.

The final corpus analyzed in this study included only a subset of the October tweets with the highest and lowest engagement for each writer. To create the corpus, the 868 tweets were first categorized by their “engagement rate.” The engagement rate of tweets is a common way to measure interactions with social media posts; it is based on a post’s “engagement actions,” which include replies, retweets (when another user simply retweets the original post), and likes. An engagement rate is the total number of engagement actions divided by the total number of user followers, then multiplied by 100. This formula results in a percentage. For example, if a tweet garners 20 replies, 10 retweets, and 100 likes, it has 130 engagement actions. If the user has 1,000 followers, the final engagement rate would be 13%: 130 / 1,000 × 100 = 13

Engagement rates differ across social media platforms, with Twitter having a relatively low engagement rate compared to Facebook or Instagram. Standards for “high” or “low” engagement rates on Twitter vary, but engagement of 0.09–0.33% is generally considered to be high, and engagement higher than 1% is unusual (Mee, 2021). In 2020, the average engagement rate for healthcare-related tweets was 0.09%, just slightly higher than the median engagement rate for all tweets that year (Jipa, 2021). The classification of engagement rates used for this study was developed based on existing benchmarks while taking into account the typical engagement with healthcare tweets; categories are shown in Table 2.
To narrow my corpus to the scientists’ most- and least-engaged tweets, I first ranked all their October 2020 tweets by engagement rate, then identified the 10 with the highest and 10 with the lowest rates for each user. Any tweets that had an engagement rate of more than 0.15% were labeled high-engagement tweets (HETs); if an individual scientist had more than 10 HETs during the month, I included only their 10 most engaged tweets in the corpus to maintain relatively even distribution amongst the users. Similarly, any tweets with an engagement rate of less than 0.05% were labeled as low-engagement tweets (LETs); if a scientist had more than 10 LETs, I included only their 10 least engaged tweets. This process yielded a total of 91 HETs and 52 LETs, for a total of 143 tweets used for analysis (see Table 3). While nearly all the scientists had 10 HETs, half of them had very few or no LETs during the period of data collection, a byproduct of their popularity on Twitter.

### Table 2

| Rate          | Category of Engagement |
|---------------|------------------------|
| >1%           | Very high engagement   |
| 0.16–0.9%     | High engagement        |
| 0.05–0.15%    | Average/goood engagement|
| 0–0.04%       | Low engagement         |

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### Table 3

| User                | Total # of Oct. 2020 tweets | Average engagement rate | # of HETs in corpus | Highest engagement rate | # of LETs in corpus | Lowest engagement rate |
|---------------------|----------------------------|-------------------------|---------------------|------------------------|---------------------|-----------------------|
| @ashishkjha         | 89                         | 1.85%                   | 10                  | 25.15%                 | 2                   | 0.03%                 |
| @FaheemYounous      | 95                         | 1.1%                    | 10                  | 9.56%                  | 0                   | 0.09%                 |
| @VirusesImmunity    | 29                         | 1.19%                   | 10                  | 6.40%                  | 1                   | 0.03%                 |
| @cmyeaton           | 14                         | 0.98%                   | 10                  | 3.64%                  | 0                   | 0.10%                 |
| @aetiology          | 63                         | 0.67%                   | 10                  | 8.20%                  | 8                   | 0.02%                 |
| @CT_Bergstrom       | 141                        | 0.66%                   | 10                  | 19.06%                 | 10                  | 0.02%                 |
| @EpiEllie           | 115                        | 0.49%                   | 10                  | 8.80%                  | 10                  | 0.01%                 |
| @KizzyPhD           | 17                         | 0.40%                   | 10                  | 0.99%                  | 1                   | 0.02%                 |
| @angie_rasmussen    | 245                        | 0.31%                   | 10                  | 5.05%                  | 10                  | 0.003%                |
| @mlipsitch          | 60                         | 0.16%                   | 1                   | 1.02%                  | 10                  | 0.01%                 |

### Findings

5. Findings

In this section, I analyze genre-related elements of the scientists’ tweets, considering characteristics of the tweet forms, topics, purposes, and audiences, and finally the identities performed through these tweets.

5.1. Tweet forms

Tweets are relatively flexible in form, with the primary constraint being the 280 character limit. I use the term “tweet type” to refer to three different (not mutually exclusive) types of posts that writers can compose. Most common is a single tweet that is no more than 280 characters. Users can also write longer posts by creating a tweet thread, in which an extended text is separated into a connected series of posts. The first segment appears in the main post, with the remaining segments appearing in the replies; each segment is usually numbered so that readers can easily follow the sequence. Quote tweets retweet another user’s post and add the new user’s own commentary; quote tweets can be a single tweet or any part of a tweet thread.

In my corpus, both the HETs and LETs were predominantly single tweets; however, threads were much more common among HETs, making up 27.5% of all HETs and only 3.8% of the LETs. In contrast, quote tweets were more common amongst the LETs, comprising 65.4% of all LETs compared to 29.7% of HETs. It is also worth noting that HETs were longer overall than the LETs, averaging 33.9 words compared to 18.1. Together, these findings suggest that HETs tend to be longer both in the original posts and in the likelihood of including follow-up threads, potentially suggesting that the inclusion of more content relates to higher tweet engagement.

Because of their digital nature, tweets can also incorporate several multimodal and hypertextual elements that can expand their reach. Images may be posted by the user or may be incorporated through quoted tweets or links to websites. Hashtags (#) are a hallmark feature of Twitter, helping to mark content so that it more easily appears in searches. Links to articles or websites make it easy to direct readers to additional content. Mentions are the inclusion of another person’s Twitter username (beginning with a @); users are notified when they are mentioned in another tweet. Finally, emojis are used easily and often in Twitter and allow writers to express content visually. Twitter encourages the use of these multimodal and hypertextual elements, stating that they are linked to higher engagement ( @smfrogers, 2014). As the examples below illustrate, they are often used in combination:
Check out our @EpiCOVIDCorps video on COVID safety for Dia de los Muertos! #COVIDHolidays #DiaDeLosMuertos #PoderEnLaSalud (@EpiEllie; 0.03% engagement; boldface added)

OMG @statnews @scchak for writing this article about me. It is not just a story about me, but of the brave and brilliant people who I surround myself with. This is a story of every #womeninSTEM. https://statnews.com/2020/10/27/akiko-iwasaki-profile-covid19-research-fighting-sexism-power-imbalances-science/via (@VirusesImmunity; 3.51% engagement; boldface added)

Despite the general popularity of hashtags, mentions, emojis, and links on Twitter, none of these elements were more common in the HETs, compared with LETs, in my corpus; only images were more prominent in HETs than LETs (see Table 4). Images were often connected to a linked or quoted article or webpage, though users occasionally posted infographics or other visuals to communicate scientific information (see Figure 1, for example), much as one might in a scientific article.

Hashtags were relatively uncommon overall, with only two hashtags being used more than once in my corpus: #COVID19 (n = 5) and #SARSCoV2 (n = 2). Links typically led to articles or media sites and were found in about a quarter of HETs and about a third of LETs. Mentioning other Twitter users was fairly uncommon in HETs, but it was found in almost half of all LETs. The scientists typically mentioned other scientists or media where their work appeared:

Chatted with @hereandnow earlier today about the state of the pandemic in Ohio and in small towns and rural areas around the country. (@aetiology, 17 Oct 2020; 0.04% engagement)

Finally, emojis were fairly uncommon among the tweets I examined, though this varied by user. The most common emojis included a finger pointing downward (↓) to indicate a linked article as well as a range of emotive facial expressions. The limited use of emojis may relate to the writers’ use of Twitter as professionals and the need to portray a professional and credible identity.

Overall, analysis of tweet forms shows that HETs were somewhat more likely than LETs to include tweet threads and to feature images. These patterns are likely related to the extent or type of content of the tweets; for example, HETs tended to provide more scientific content, which is also more likely to be communicated through multi-tweet threads and to incorporate images such as tables or charts. I explore these features in the next section.

### 5.2. Tweet topics, purposes, and audiences

One of the most important situational features of science tweets and other digitally mediated forms of communication is that they are polycontextual (Engeström et al., 1995), “simultaneously realizing multiple purposes, reaching diverse..."
audiences, populating manifold networks, and drawing in publics previously positioned as consumers of science.\textsuperscript{(Reid & Anson, 2019, p. 220). This multidimensionality of tweets—written on numerous topics, for multiple purposes, and for a range of audiences—was prominent in my corpus of tweets as well. Although topics, purposes, and audiences overlap significantly, I first analyze them distinctly and later consider how these aspects of communication work together to form a range of tweet genres.}

5.2.1. Topics

Though one might suspect that scientists use Twitter solely to communicate scientific information—especially during a pandemic—the prominent users in my corpus tweet about a range of topics, much like the medical professionals\textsuperscript{(Myers, 2015)} and communication scholars\textsuperscript{(Jünger & Fähnrich, 2020)} in previous studies. I identified five broad topic areas in the corpus, with nearly all tweets discussing one or more of these. Three disciplinary-focused topic areas included COVID-19, scientific information unrelated to COVID-19, and professional information (for example, announcing publications, jobs, or sharing disciplinary practices). Yet, tweets also focused on personal topics and politics, as illustrated below:

\begin{enumerate}
\item[(4)] Be the same person: at work, at home and on social media. (@FaheemYounous; 9.56\% engagement)
\item[(5)] My mentions, emails full of people angry I'm not blaming president for his infection. In medicine & public health, you don't blame patients when they're sick. You look for systemic failures. He's ill. I want him better. Let's focus on protecting the American people moving forward. (@ashishkjha; 6.70\% engagement)
\end{enumerate}

The HETs and LETs differed more markedly in topic focus than in form (see Table 5). The HETs included a much higher percentage of tweets about COVID-19 and politics in comparison with the LETs, though COVID-related tweets still made up a third of the LETs and were the most common topic area overall. Tweets with political content were very rare in the LETs but made up almost one-third of HETs, suggesting that political content was of high interest to Twitter users during this time period. That said, 24 of the 29 tweets about politics were also COVID-related, possibly reflecting the politicized nature of public health in the US. Also notable is that tweets focused on professional information received much less engagement overall. Even tweets about science but not about COVID were very unlikely to garner high engagement in this time period. Overall, we see that tweet content focusing on topics of strong public interest (COVID-19 and politics) was well represented among HETs during October 2020. Given the public health and political environment in the US at that time, the high interest in these tweets is predictable. In contrast, more specialized content (science and professional or self-promotional topics) was of interest to a much smaller audience of users.

\begin{table}[h]
\centering
\caption{Topics of the High- and Low-Engagement Tweets}
\begin{tabular}{lcc}
\hline
Tweet Topic\textsuperscript{a} & HETs (\%) & LETs (\%) \\
\hline
COVID-19 & 73.6\% & 34.6\% \\
Politics & 30.8\% & 1.9\% \\
Professional & 15.4\% & 46.2\% \\
Personal & 13.2\% & 15.4\% \\
Science, non-COVID & 2.2\% & 15.4\% \\
Other & 0\% & 3.8\% \\
\hline
\end{tabular}
\textsuperscript{a} Some tweets had more than one topic, so columns add up to more than 100\%.
\end{table}

5.2.2. Purposes

Also relevant to scientists' Twitter activity is an understanding of the communicative purpose of their tweets—that is, what is the tweet aiming to do? I analyzed the purpose of each tweet in the corpus; when tweets had more than one apparent purpose, both were recorded. Nearly all of the 143 tweets fell into at least one of eight categories of communicative purpose, shown in Table 6.

\begin{table}[h]
\centering
\caption{Communicative Purposes of the High- and Low-Engagement Tweets}
\begin{tabular}{lcc}
\hline
Tweet Purpose\textsuperscript{a} & HETs (\%) & LETs (\%) \\
\hline
React to an event & 44.0\% & 0\% \\
Share scientific information & 41.8\% & 0\% \\
Announce event, publication, appearance & 9.9\% & 59.6\% \\
Share a story & 9.9\% & 1.9\% \\
Share an idea & 4.4\% & 1.9\% \\
Call attention to something (non-science-related) & 2.2\% & 0\% \\
Respond to another tweet & 1.1\% & 7.7\% \\
Ask for recommendations & 0\% & 1.9\% \\
\hline
\end{tabular}
\textsuperscript{a} Some tweets had more than one purpose, so columns add up to more than 100\%.
\end{table}
In reacting to current events, the scientists were able to join popular Twitter conversations, but they also frequently shared political opinions, likely increasing their popularity among some Twitter users but decreasing it among others. Once again, we see the strong overlap here between politics and public health, mirroring the overlap of these domains in US society at large. It is indeed nearly impossible to separate politics from public health in US—an entanglement which has complicated the country’s ability to deal effectively with public health crises.

Another notable difference between the HETs and LETs in terms of communicative purpose was users’ lack of engagement with tweets that announced events, publications, or appearances, as in @angie_rasumussen’s tweet: *I'll be talking to @TanyaRivero on @CBSNLive about #COVID19 treatments in 5 min. Join us online!* (0.01% engagement). These “announcement tweets” made up 60% of the LETs but accounted for only 10% of the HETs. Such tweets may be less likely to garner engagement because they are time-sensitive (in the case of media appearances) and may appeal only to a limited audience (in the case of professional networking, they are unlikely to attract broad public engagement. In my corpus, professionally oriented tweets made up just 16.5% of all HETs. Instead, tweets that appeal to a wide audience and do not rely on specialized or insider knowledge are most likely to accrue likes, retweets, and replies from a broader public audience. The data suggest that these writers are aware of their multiple Twitter audiences and do not give up on the use of Twitter for narrower, professional networking, they are unlikely to attract broad public engagement.

### 5.2.3. Audiences

The analysis of tweet topic and communicative purpose demonstrates how scientists can use Twitter to appeal to both public audiences and to professional insiders. Audience is indeed a central component of writing, shaping many aspects of a text, from content to linguistic choices. In genre theory, audience has often been conceptualized through the metaphor of community (e.g., Prior, 1998; Swales, 1990), with communities developing genres in ways that carry out their needs and, as a result, index community practices and values. Communities and audiences, however, are somewhat more complex in media like Twitter where numerous, overlapping readerships interact. Marwick and boyd (2011a) argue that despite not knowing exactly who their audience is, social media users “have a mental picture of who they’re writing or speaking to” (p. 128)—that is, they invoke a particular audience and adapt their writing accordingly (Ede & Lunsford, 1984). Smith’s (2015) interview study of scientists on Twitter suggests that such imagined audiences may be more crude than they are nuanced. The scientists she interviewed generally drew only a basic distinction between science and non-science readerships. Yet a smaller number did describe envisaging specific readers, such as “their mothers, PhD supervisors or employers, [as] a litmus test of acceptable communication” (Smith, 2015, p. 331).

In this study, I examined tweets for only broad evocations of audience, distinguishing those that were written primarily for public vs. professional communities. Using Twitter to communicate within a professional community is quite common, as described in section 2, and such “in-group” tweets were pervasive amongst LETs (see Table 7). These professionally oriented posts often made use of insider language and references, as in this example:

> T cells: key regulators of the COVID-19 immune response. Read about their role in protection and disease from two colleagues in the Graham lab at the VRC/NIH T cell immunity to SARS-CoV-2 following natural infection and vaccinat... (@KizzyPhD; 0.26% engagement)

In other cases, tweets for professional insiders were more understandable to non-scientists but provided information that was only relevant to the professional community: *Here is one heck of an amazing career opportunity for researchers in the life sciences.* (@CT_Bergstrom; 0.04% engagement).

| Primary Audience | HETs (%) | LETs (%) |
|------------------|----------|----------|
| Public           | 83.5%    | 48.1%    |
| Professional     | 16.5%    | 51.9%    |

Though tweets written specifically for disciplinary insiders are an important part of scientists’ use of Twitter for professional networking, they are unlikely to attract broad public engagement. In my corpus, professionally oriented tweets made up just 16.5% of all HETs. Instead, tweets that appeal to a wide audience and do not rely on specialized or insider knowledge are most likely to accrue likes, retweets, and replies from a broader public audience. The data suggest that these writers are aware of their multiple Twitter audiences and do not give up on the use of Twitter for narrower, professional networking.
5.3. Identities

As the discussion of tweet topics and purposes already suggests, Twitter users often make different identities more or less prominent as they engage diverse audiences for purposes ranging from informing the public to announcing publications to sharing personal anecdotes. To explore identity in these tweets, I take a qualitative approach focusing on how the writers adopt different roles and perform a range of identities in their tweets. Following Goffman (1959), identity can be viewed as a performance, with individuals adapting their self-presentation across contexts and audiences, “frontstaging” and “back-staging” different representations of self as appropriate. In this orientation, identity is also co-constructed through interaction, as people monitor responses to their self-presentation and adjust accordingly. Researchers of academic writing have effectively demonstrated how identity is co-constructed by writers and readers through the texts in which we engage and the semiotic choices that authors make in creating those texts (Hyland, 2012, 2015; Ivanič, 1998; Matsuda, 2001; Tardy, 2016).

Genres also offer writers certain roles and identities to take on while restricting others. In writing a research article, for example, one assumes the identity of an expert in the paper’s subject-matter. By invoking the discourses of a particular genre and discipline, authors position themselves in relation to a community who uses those discourse and genres; conformity to example, one assumes the identity of an expert in the paper

Expert identities were prominent in both HETs and LETs, though in somewhat different ways. In HETs, the writers tended because expertise is in many ways always present in these users

Because expertise is in many ways always present in these users’ posts, even tweets that do not foreground their credentials perform expertise. For example, the following tweet evokes an expert identity in its use of the phrase “age-specific disease dynamics” and its assertion that schools could be reopened with certain mitigation measures:

At the same time, the author situates himself as part of a community of users (through the use of we) and as someone who balances social and educational concerns with scientific ones. By foregrounding (but not omitting) his expert identity, the writer is able to remain relatable, yet credible, to a broad range of readers. The discursive environment of Twitter allows for this kind of dexterity, balancing and blending identities within a single post.

Expert identities were prominent in both HETs and LETs, though in somewhat different ways. In HETs, the writers tended to blend their expert identities with other broadly familiar and approachable identities, such as engaged or critical citizen, politically minded person, witty tweeter, or parent. By asserting these multidimensional selves—both scientist and concerned citizen, for example—they are likely to be more relatable to non-specialist readers. The following examples illustrate how the writers integrate their expert and more relatable identities in their tweets:

This is a really important point. We achieve “herd immunity” through vaccination, not natural infection. We have NEVER used herd immunity via naturally acquired infection as a public health strategy, due to the unacceptable losses of life and quality of life that would result. (@angie_rasmussen; 3. 54% engagement)

Was at dinner (outside) with kids last pm
Youngest says
“You’re so boring on TV. You say same things over and over again”
Then mockingly
Wear a mask
Keep distance
Avoid indoor dining and bars
In the first example, the writer could relate this specialist information in a much more neutral manner, but instead she uses personal pronouns (we), informal writing features (NEVER), language characteristic of spoken registers (This is a really important point), and the use of scare quotes around herd immunity, while also emphasizing a compassionate human perspective (unacceptable losses of life). In the second example (the tweet with the highest engagement rate in my corpus), the writer shares a relatable story of his child ridiculing him (we can almost hear his child’s mocking voice), all while noting his status as a reputable professional and repeating public health measures that he advocates for.

Expert identities were also asserted in LETs, but here they tended to be integrated with insider professional or public scientist identities, in which writers acted primarily as equal peers. Many of these, for example, shared colleagues’ work or professional opportunities, as in this example of a tweet that shares another post of a new publication:

Looking forward to reading this. (@mlipsitch; 0.02% engagement)

While these specialist identities lend authority to the writers, they are less relatable and inclusive for a general public audience, likely explaining in part the lower engagement of the tweets written for professional insiders.

The corpus also included numerous tweets in which the writers fully avoided their expert identities. Often, these tweets positioned the scientists as a fellow concerned citizen or simply another person trying to muddle through the challenges of a pandemic:

USA: We’ve got 34 cases connected to the White House, but the Rose Garden attendees are performatively refusing testing. ( @CT_Bergstrom; 19.06% engagement)

RIP to my clothes from last fall & winter which 100% no longer fit. ( @EpiEllie; 1.30% engagement)

Often these tweets, like the above, are playful or clever, making them more likely to attract attention (and thus be retweeted) and to invoke an emotional response among readers (and thus be “liked”). Playfulness and humor are common on social media but are rhetorical features that are minimized in most academic genres; the broad discursive environment of Twitter, however, affords the use of more semiotic resources for constructing identities.

Although the identities performed in HETs tended to be those that were most relatable to a broad public, the writers also asserted non-professional, in-group identities in their tweets written for narrower audiences. For example, writers evoked their identities as teachers, sports fans, Spanish speakers, and birders. In short, these writers recognized the expansive reach of Twitter and the ability to write to broad and narrow audiences, and they adapted their performances of identity accordingly. While writing for specialized audiences and invoking specialized identities was less likely to garner high engagement, these rhetorical strategies serve other purposes for writers, allowing for in-group networking and interaction. In performing these multiple identities, the writers also show themselves to be more than scientists but rather multifaceted people with various interests and communities, similar to the performance of multiple identities on an academic homepage (Hyland, 2012).

Though not all tweets are carefully planned, it is unlikely that these specific writers have not given some thought to their use of Twitter and their self-presentation on the platform, given their high visibility. They demonstrate an ability to present themselves as national experts who are not neutral, distant scientists but rather are fellow humans with families and emotions. By revealing aspects of their personal lives, they create a level of intimacy, letting even distant readers feel they know them on some level. Luzón (2013, 2019) shows how academic bloggers use this same strategy, disclosing personal details, and expressing emotional reactions that “contribute to establishing a close social distance” (Luzón, 2019, p. 187).

As a reminder, the ten users in this study are all prominent on Twitter and also in the media more generally, akin to “public health celebrities” in the time of COVID. In many ways, the rhetorically strategic choices that they make in their tweets mirror those used by larger celebrities on Twitter. For instance, the strategy of balancing personal and public information and identities has been found to contribute to an impression of authenticity for celebrities on Twitter. As Marwick and boyd (2011b) show, celebrities strategically manage and limit personal information, “presenting a seemingly authentic, intimate image of self while meeting fan expectations” (Marwick & boyd, 2011b, p. 140). In an analysis of tweets by astrophysicist Neil DeGrasse Tyson, for example, Fahy and Lewenstein (2021) found that Tyson primarily tweeted about cosmology but also judiciously shared personal details, “enhanc[ing] intimacy between him and his followers” (p. 41). Again, Twitter’s poly-contextual and polygeneric nature facilitates this kind of identity assemblage.

5.4. Summary of Findings

I have shared here an analysis of a small-scale corpus of high- and low-impact tweets by ten prominent epidemiologists during a surge in COVID-19 cases in 2020. Though these findings are tentative based on the limited scope of the data, they suggest some differences in characteristics of HETs and LETs. Among these high-profile writers, HETs were more likely to be
slightly longer, include images, focus on COVID-19 and/or politics, react to current or political events, and be written for a broad, non-specialist readership. In contrast, LETs tended to be shorter, focus more on professional information, and be written for in-group professional readers. LETs often shared announcements of the writers’ upcoming media appearances. The analysis also reveals that writers perform and manage multiple identities in their Twitter activity. While expert identities are extremely common, they also represent aspects of their more personal selves, for example, as parents, concerned citizens, or witty tweeters. In doing so, they appear more relatable and reduce social distance between themselves and their readers.

6. Discussion and Implications

Findings from this research can inform our understanding of genre theory by shedding light on emerging digital genres. Analyzing the tweets in this study in relation to elements of genre form (tweet types and multimodal or hypertextual features), topic, purpose, audience, and identity emphasizes the need to conceptualize tweets not as a single genre but rather as multiple genres that intermingle in a digital space. Much like there are multiple genres of emails (e.g., requests, apologies, announcements, spam), Twitter allows writers a means for communicating with different readers for different purposes—uniquely, on Twitter, these different types of communication coexist and are visible to all intended and unintended audiences. The contextual features and constraints of microblogs then give rise to and afford a range of social actions, as diverse as informational tweetorials, media appearance announcements, reactions to current events, and sharing of personal anecdotes. Some of these actions (such as tweetorials) may be established enough to be considered genres, while others are evolving or emerging genres or subgenres, or may even function more like speech acts. Savvy and rhetorically flexible Twitter users capitalize on this polygeneric nature of Twitter to gain followers, visibility, and ultimately impact.

This ability to marshal generic and discursive resources on Twitter also enables writers to manage and perform multiple identities across the platform. For example, sharing colleagues’ publications highlights a disciplinary peer identity while contributing to the construction of a small-group community; providing public health advice in an accessible manner highlights a reliable expert identity; sharing a humorous story affords a human identity. The cumulative effect seems to be the development of a multidimensional, relatable expert identity—someone who shares credible scientific information but who also experiences life’s challenges, has political opinions, and occasionally engages in witty or playful banter. In other words, it is not simply the use of certain topics, purposes, and identities (that is, the use of different genres) that helps these scientists to maintain high levels of engagement on Twitter, but rather it is likely the totality of these, the effect of a using full repertoire of genres and identities that display them as a certain kind of expert—one that is likeable and worth following.

Twitter is an especially interesting site of communication because it allows a writer to enact so many identities in one digital forum, viewable by the same people in close chronological proximity. For example, while a research journal (print or web-based) limits writers to performing a fairly narrow range of roles and identities, Twitter compiles them into one space. Writers then must learn to orchestrate their identity performances in this digital space in a way that contributes to an overarching goal for the platform. An important implication here is that to understand the effects of communication in highly networked and intertextual digital platforms like Twitter, it is likely insufficient to examine single genres (e.g., “informational science tweets”) but rather we must look at how scientists use a repertoire of genres and identities to engage diverse audiences for multiple purposes. In this manner, the scientists in this study were able to harness the full potential of social media, using multiple genres, discourses, and identities strategically to enact their aims as public scientists.

It is also noteworthy that the networks of genres on a social media platform, though interlinked, differ in their coordination from the genre systems or sets described in earlier genre studies (e.g., Bazerman, 1994; Berkenkotter, 2001; Devitt, 1991). While previous research has demonstrated how genres work together to carry out the activity of a community of practice, such as tax accountants or psychotherapists, the genres of social media are less overtly reliant on each other. A Twitter user does not need to utilize multiple genres to use the platform but doing so may afford them more options for engaging with different readers and presenting various aspects of self, ultimately expanding their reach and their uses of social media. A scientist who details funny family anecdotes, educates the public about a new vaccine, and shares research preprints with colleagues, for example, may become more trustworthy to readers simply because we get to see them as multidimensional beings.

This research also has implications for ESP instruction. Pérez-Llantada’s (2021) survey of authors from four prominent science journals found that 75% of respondents relied on “parascientific multimodal genres” (e.g., research websites, academic blogs, and social networking posts) to reach non-specialist audiences. Thus, while scientific papers persist as the most important writing for scientists (and should still be prioritized for specialized academic writing classrooms), there is increased recognition of a role for less formal and more public-facing communication as well. The importance of communicating with non-specialists means that scientists and other academics need expansive repertoires of written communication. Learning to communicate specialized content in new genres—from academic blogs to social media genres—is likely to become increasingly important for researchers. This research also suggests that the management of identity performance across genres is important for scientists who wish to reach broader publics. One valuable strategy for ESP instruction then is to pair the teaching of high-stakes academic genres with opportunities for recontextualizing research content into new genres and for a range of audiences. Such recontextualization activities not only help writers to build familiarity with multiple genres, but they also support the development of genre awareness and rhetorical flexibility (Johns, 2008). Further, exploring how specialists manage their personal and professional identities in digital spaces can benefit students as they learn new strategies for self-presentation. Finally, incorporation of social media genres into EAP courses—even in very small, low-stakes
activities—offers the potential to bring more playful aspects of academic writing to the fore, potentially motivating students and contributing to their overall awareness of how writers exploit texts for their own goals (Tardy, 2021).

7. Further Directions

This small-scale study has shared insights into how scientists use the digitally mediated genres of Twitter to communicate with other specialists and wider public audiences. Nevertheless, the study is limited in time and scope. Examination of a larger corpus, more users, and different time periods would help expand our understanding of how scientists and other specialists communicate with the public through digital social media platforms.

Future research can also examine interaction in microblogs by looking not just at original posts but also the replies. Exploration of the comments, including the identities they perform and how they position the original poster, could enrich our understanding of how identities are co-constructed and negotiated on social media. Analysis of posts and their comments may also help elucidate a more complex understanding of how community is co-constructed in spaces as open and diverse as social media platforms.

Findings in this study also suggest that Twitter threads often attracted high engagement and that they frequently shared valuable scientific information. Studies that explore the use of microblog threads as a means for communicating with the public would contribute to our understanding of how writers stretch the constraints of social media genres to provide more in-depth content. Graham’s (2020, 2021) work begins this exploration by studying educational tweetorials, but there is room for more analysis of the rhetorical and linguistic strategies that make such threads successful. Additionally, the present study provided only a snapshot of Twitter use by very established users. Future research could look at how prominent scientists on Twitter have evolved in their use of Twitter over time. Such research could provide insight into how writers implicitly build their digital literacy and knowledge of the genres they can use and exploit on social media. Finally, given the prominence and very real threats of science-related misinformation on social media, research should further explore how scientists effectively combat misinformation when communicating with the public.

Data availability

Data will be made available on request.

References

@smfrigers. (2014, March 10). What fuels a Tweet’s engagement? Twitter Blog. https://blog.twitter.com/en_us/a/2014/what-fuels-a-tweets-engagement.

Bazerman, C. (1994). Systems of genres and the enactment of social intentions. In A. Freedman, & P. Medway (Eds.), Genre and the new rhetoric (pp. 79-101).

Taylor & Francis.

Berkenkotter, C. (2001). Genre systems at work: DSM-IV and rhetorical recontextualization in psychotherapy paperwork. Written Communication, 18(3), 326-349. https://doi.org/10.1177/0741088301018003004.

Brown, A. (2020, March). Coronavirus: The most essential people to follow on Twitter during the COVID-19 outbreak. Forbes. https://www.forbes.com/sites/abrambrown/2020/03/14/coronavirus-the-most-essential-people-on-twitter-to-follow-during-the-covid-19-outbreak/?sh=166f83047353

Côté, I. M., & Darling, E. S. (2018). Scientists on Twitter: Preaching to the choir or singing from the rooftops? FACETS, 3(1) https://doi.org/10.1139/facets-2018-0002.

Devitt, A. J. (1991). Intertextuality in tax accounting: Generic, referential, and functional. In C. Bazerman, & J. Paradis (Eds.), Textual dynamics of the professional professions: Historical and contemporary studies of writing in professional communities (p. 336). University of Wisconsin Press. -255.

Ede, L., & Lunsford, A. (1984). Audience addressed/audience invoked: The role of audience in composition theory and pedagogy. College Composition and Communication, 35(2), 155-171. https://doi.org/10.2307/358093.

Engeström, Y., Engeström, R., & Kärikäinen, M. (1995). Polycontextuality and boundary crossing in expert cognition: Learning and problem solving in complex work activities. Learning and Instruction, 5(4), 319-336. https://doi.org/10.1016/0925-3574(95)00021-6.

Eve, B., & Lewenstein, B. (2021). Scientists in popular culture: The making of celebrities. In M. Bucchi, & B. Trench (Eds.), Routledge handbook of public communication of science and technology (3rd ed.), (pp. 33-52). Routledge.

Goffman, E. (1959). The presentation of self in everyday life. Anchor Books.

Graham, S. S. (2020). Where’s the rhetoric?: Imagining a unified field. The Ohio State University Press.

Graham, S. S. (2021). Misinformation inoculation and literacy support tweetorials on COVID-19. Journal of Business and Technical Communication, 35(1), 7-14.

Hu, G., & Liu, Y. (2018). Three-minute thesis presentations as an academic genre: A cross-disciplinary study of genre moves. Journal of English for Academic Purposes, 35, 16-30. https://doi.org/10.1016/j.jeap.2018.06.004.

Hyland, K. (2012). Disciplinary identities: Individuality and community in academic discourse. Cambridge University Press.

Hyland, K. (2015). Genre, discipline and identity. Journal of English for Academic Purposes, 19, 32-43.

Ivanic, R. (1998). Writing and identity: The discoursal construction of identity in academic writing. John Benjamins.

Jipa, A. (2021, January 19). 2021 Social media industry benchmarks – Know exactly where you stand in your market. Socialinside, https://www.socialinside.io/blog/social-media-industry-benchmarks/#:~:text-To%20understand%20the%20potential%20of,an%20average%20rate%20of%201.65%25

Jünger, J., & Fähnrich, B. (2020). Does really no one care? Analyzing the public engagement of communication scientists on Twitter. New Media & Society, 22(3), 387-408. https://doi.org/10.1177/146144481883413.

Lorès, K. (2020). Science on the web: The exploration of European research websites of energy-related projects as digital genres for the promotion of values. Discourse, Context & Media, 35, 100389. https://doi.org/10.1016/j.dcm.2020.100389.

Luzón, M. J. (2013). Public communication in science blogs: Recontextualizing scientific discourse for a diversified audience. Written Communication, 30(4), 428. https://doi.org/10.1077/j0741088313493610. -357.

Luzón, M. J., & Albero-Posac, S. (2020). ‘Had a lovely week at #conference2018’: An analysis of interaction through conference tweets. RELC Journal, 51(1), 45-61.

Luzón, M. J., & Pérez-Llantada, C. (2019). Connecting traditional and new genres: Trends and emerging themes. In M. J. Luzón, & C. Pérez-Llantada (Eds.), Science communication on the internet: Old genres meet new genres (pp. 1-18). John Benjamins.

Marwick, A. E., & boyd, d. (2011a). ‘I tweet honestly, I tweet passionately’: Twitter users, context collapse, and the imagined audience. New Media and Society, 13(1), 114-133. https://doi.org/10.1177/1354856510394539.
Marwick, A., & boyd, D. (2011b). To see and be seen: Celebrity practice on Twitter. *Convergence: The International Journal of Research into New Media Technologies, 17*(2), 139–158.

Matsuda, P. K. (2001). Voice in Japanese written discourse: Implications for second language writing. *Journal of Second Language Writing, 10*(1-2), 35-53.

Matsuda, P. K., & Tardy, C. M. (2007). Voice in academic writing: The rhetorical construction of author identity in blind manuscript review. *English for Specific Purposes, 26*(2), 235-249.

Mee, G. (2021, May 10). What is a good engagement rate on Twitter? Scrunch. https://scrunch.com/blog/what-is-a-good-engagement-rate-on-twitter.

Miller, C. R. (1984). Genre as social action. *Quarterly Journal of Speech, 70*, 151–167.

Myers, G. (2015). Social media and professional practice in medical Twitter. In M. Gotti, S. Maci, & M. Sala (Eds.), *Insights into medical communication* (pp. 51-69). Peter Lang.

Orpin, D. (2019). #VaccinesWork: Recontextualizing the content of epidemiology reports on Twitter. In M. J. Luzón, & C. Pérez-Llantada (Eds.), *Science communication on the internet: Old genres meet new genres* (pp. 173–194). John Benjamins.

Peikoff, K. (2020, March 6). The best coronavirus experts to follow on Twitter. Leaps.org. https://leaps.org/the-best-coronavirus-experts-to-follow-on-twitter/

Prior, P. A. (1998). *Writing/disciplinarity: A sociohistoric account of literate activity in the academy*. Routledge.

Perrin, A., & Anderson, M. (2019, April 10). Share of U.S. adults using social media, including Facebook, is mostly unchanged since 2018. Pew Research Center. https://www.pewresearch.org/fact-tank/2019/04/10/share-of-u-s-adults-using-social-media-including-facebook-is-mostly-unchanged-since-2018/

Reid, G., & Anson, C. (2019): Public- and expert-facing communication: A case study of polycontextuality and context collapse in Internet-mediated citizen science. In M. J. Luzón, & C. Pérez-Llantada (Eds.), *Science communication on the internet: Old genres meet new genres* (pp. 219-238). John Benjamins.

Rowley-Jolivet, E., & Carter-Thomas, S. (2019). Scholarly soundbites: Audiovisual innovations in digital science and their implications for genre evolution. In M. J. Luzón, & C. Pérez-Llantada (Eds.), *Science communication on the internet: Old genres meet new genres* (pp. 81-106). John Benjamins.

Smith, A. (2015). “Wow, I didn’t know that before; thank you”: How scientists use Twitter for public engagement. *Journal of Promotional Communications, 3*(3), 320-339.

Society for Epidemiologic Research (n.d.). Epidemiologists on Twitter. https://epiresearch.org/epidemiologists-on-twitter-list/.

Swales, J. M. (1990). *Genre analysis: English in academic and research settings*. Cambridge University Press.

Tardy, C. M. (2021). *Beyond convention: Genre innovation in academic writing*. University of Michigan Press.

Tarde, C. M. (2021). The potential power of play in second language academic writing. *Journal of Second Language Writing, 53*, 100833.

Tereszkiewicz, A. (2015). Medical doctors on Twitter: How and why MDs tweet. In M. Gotti, S. Maci, & M. Sala (Eds.), *Insights into medical communication* (pp. 71-92). Peter Lang.

Vicente-Saez, R., & Martinez-Fuentes, C. (2018). Open science now: A systematic literature review for an integrated definition. *Journal of Business Research, 88*, 428–436. https://doi.org/10.1016/j.jbusres.2017.12.043.

Zou, H., & Hyland, K. (2022). Stance in academic blogs and three-minute theses. *International Journal of Applied Linguistics*. https://doi.org/10.1111/ijal.12411. Advance online publication.

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