Twitter as the social media of choice for sharing science

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Abstract

Science is becoming increasingly politicized and scientists need to better connect with the public. One route to public engagement is through social media. In particular, Facebook and Twitter are becoming increasingly popular among the public (Pew Research Center 2013). However, we lack empirical evidence about scientists' social media use habits and their perceptions of these communication technologies. Here, we examine scientists' use

of social media for both general and science-related purposes. We find scholars who actively seek new ways to share their work tend to turn most often to Twitter. Our results indicate that scientists are more accepting of Twitter, relative to Facebook, as a medium for dissemination and discussion of science, both within and outside their fields. We anticipate that Twitter will continue to grow as a medium for scientific discourse and future scholarship should examine the impacts of such forms of communication on public policy and public attitudes toward science.

Introduction

The spheres of science and politics are drawing increasingly closer. Recently, Republican senator Tom Coburn's proposed amendment to block National Science Foundation (NSF) funding for political science passed in the House of Representatives, and his ambitions go beyond the social sciences. In a letter to the NSF, the Oklahoma senator urged that funding for projects in robotics and ecology, among other disciplines be reconsidered (Coburn 2013). New legislation, known as the High Quality Research Act, proposed by Lamar Smith, the Republican chairman of the House Committee on Science, Space, and Technology further draws linkages between scientific endeavors and politics (Rogers 2013). And, of course, taxpayer money already funds research in politically contentious issues, including climate science, evolution, and stem cell research.

In light of increasing politicization, scientists need to better connect with public audiences, whose taxes fund approximately 60 percent of the academic research conducted in the U.S. (National Science Board 2012). How the American public perceive and understand science and its practitioners will likely affect the types of scientific research and development the federal government supports. One way for scientists to connect with the public is through new communication technologies afforded by advances of the Internet. Facebook, Twitter, and other forms of online social media are increasingly breaking down barriers between scientists, societal elites, and lay audiences. Politicians, most notably Barack Obama, have successfully used social media to organize and motivate members of the public. While it is reasonable to think scientists can also use such tools to garner support for their research, we lack empirical evidence of scientists'

use and perceptions of social media. How and why do scientists use social media? And, what are their perceptions of web 2.0 technologies?

Method

To answer these questions, we conducted a survey of tenure-track scientists at a large Midwestern research university. Data were collected as part of a broader web-based survey, which was accessible from any computer with Internet access. The survey focused on scientists' perceptions of public attitudes towards controversial science, but we also asked scientists about their use of social media for both general and science-related purposes, and their attitudes toward such use. Demographic information, including gender, age, years since receiving doctorate, political affiliation, and scientific division were collected at the end of the survey. Using these data, we explored variables that influence general social media use and, more specifically, use of the social networking platforms Facebook and Twitter. *Social media use*, *frequency of Facebook use*, and *frequency of Twitter use* served as dependent variables for our analyses. *Social media use* was a binary variable measured by asking respondents whether they use social media for general purposes. *Frequency of Facebook use* (M = 2.35, SD = 1.10) and *Twitter use* (M = 1.72, SD = 1.03) were measured by asking respondents to report their level of use of the respective platforms for science-related purposes on a 4-point scale, ranging from "Never use" to "Frequently use."

In addition to gender, respondents were asked which University Divisional Committee they identified with in order to categorize their *discipline*. Participants were given three options ("Biological Sciences," "Physical Sciences," and "Social Studies/Social Sciences") and were allowed to select more than one. These were recoded into two binary variables (*biological sciences* and *physical sciences*) with 'Social Studies/Social Sciences' as the reference group. Our measure of *age* is a mean index composed of the respondent's age and years since she/he received her/his doctorate degree (M = 36.25, SD = 10.60). *Ideological extremity* was constructed from two items. The first item measured political ideology on a 7-point Likert scale based on economic issues (1 = "Very liberal," 7 = "Very conservative"). The second item, using the same scale, asked respondents to rate their ideology based on social issues. The two items were

then recoded by folding over the response categories (e.g., responses of '4' were recoded as '1', responses of '3' and '5' were recoded as '2', responses of '2' and '6' were recoded as '3', and responses of '1' and '7' were recoded as '4'). Responses to the two folded items were then averaged to create an index of *Ideological extremity* ranging from 1 to 4 (M = 2.89, SD = 0.82). We also measure *media use* by asking respondents how often they used newspapers and television, both online and offline, for science news within and outside their fields of study, using four-point scales (1 = "Never," 4 = "Frequently"). *Newspaper use* (M = 3.25, SD = 0.86) and *television use* (M = 2.18, SD = 0.94) were constructed by averaging responses to these questions.

In order to identify clusters of items associated with *active* and *passive use of social media*, we conducted a factor analysis. Principal component analysis (PCA) was conducted on 9 items with oblique rotation and was used to identify and compute composite scores for the factors underlying social media use. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.87, above the recommended value of 0.6 (Dziuban and Shirkey 1974, Kaiser 1970, Kaiser and Rice 1974) and Bartlett's test of sphericity was significant ($\chi^2(36) = 869.51$, $p < .001$). Additionally, the communalities were greater than 0.3 (Table 1), confirming that correlations between items were sufficiently large for factor analysis. Two components had initial eigenvalues over Kaiser's criterion of 1 and explained 58.5 percent of the variance in combination. Items that clustered on the same components suggest that component 1 and 2 represent what we have deemed *Active* (Cronbach's alpha = .90) and *Passive social media use* (Cronbach's alpha= .47), respectively.

Two other independent variables were included in our models; perception of public interest in one's own research and scientists' attitudes toward actively seeking ways to share their research. *Positive perception of public interest in one's research* (M = 3.37, SD = 1.05) was measured using one item asking respondents how much they agreed with the following statement on a 5-point Likert scale (1 = "Strongly disagree," 5 = "Strongly agree"): "There are lay audiences interested in what I have to share about science and research on social media." *Actively seeking new ways to share research* (M = 2.03, SD = 1.10) was measured with one item. Respondents indicated how much they agreed with the statement, "I actively seek new ways to use social media to share science

and research," using a 5-point scale ranging from "Strongly disagree" to "Strongly agree."

Table 1. Factor loadings and communalities of items measuring active and passive use of social media for science-related purposes ($N = 240$).

Item	Factor loadings		Communality
	Active	Passive	
Using social media improves my job performance	**0.84**		0.71
Using social media enables me to more effectively engage with scientists and researchers who are in my peer community	**0.83**		0.69
Using social media increases my research productivity	**0.81**		0.66
I receive high quality information about science and research using social media	**0.83**		0.68
Using social media enables me to more effectively engage with lay audiences interested in my research	**0.77**		0.6
Social media is a great way to get current science and research information	**0.82**		0.68
I am too busy to participate in social media, but I wish I had time to use it	0.1	**0.78**	0.62
I am concerned that using social media will consume too much time once I get started	-0.26	**0.63**	0.46
I use social media only to receive information		**0.68**	0.46

Note: Factor loadings less than 0.1 are not shown.

Results and Discussion

We received responses from 20.5 percent (N = 254) of the 1,239 biological, physical, and social scientists we contacted. Our sample was mostly male (71 percent) and 95 percent of respondents were between the ages of 32 and 66 (M = 47.27, SD = 18.12). Their average scientific age, the number of years since receiving their doctorate degree, was 21.12 (SD = 10.81). Scientists were asked to select a divisional committee to identify their discipline. The largest group of respondents identified with the biological sciences (37.4 percent), followed by the social (30.9 percent) and physical (30.1 percent) sciences. Four respondents identified with more than one division and were thus excluded from the analysis.

As a first analysis, we examined the percentage of scientists who use social media for general (non-scientific) purposes and specific platforms for science-related purposes (Table 2). Compared to the general population (Pew Research Center 2013), fewer scientists reported using social media in general. Among these, the proportion of

scientists who use Facebook for science-related purposes is comparable to the public at large. Interestingly, a larger proportion of scientists use Twitter compared to the general public. This lends some credibility to the idea that some forms of social media, particularly Twitter, may be a viable outlet for scholarly discussion and one that may be viewed among scientists as having the potential to increase research productivity (Bik and Goldstein 2013).

Table 2. Comparison of scientists and the general public who use social media.

	% of scientists who…[a,b]	% of general public who…
Use social media for general purposes	60.6	67.0
Use Facebook	70.0	67.0
Use Twitter	40.0	16.0
Use YouTube	76.2	—
Use LinkedIn	58.3	—
Use restricted online communities (ResearchGate, Mendeley)	49.0	—
Use blogs	72.8	—
Use wikis	88.7	—

[a]Values refer to % of scientists who use social media for science-related purposes.
[b]Includes respondents who reported using social media outlets seldom, occasionally, and frequently.

To examine factors that influence social media use for general purposes, we used a logistic regression model (Table 3). Independent variables were entered into the model in blocks in assumed causal order. Unsurprisingly, age was negatively correlated with social media use, with younger scientists more likely to use social media than their older counterparts. Both sharing and receiving scientific information on social media were correlated with general use of social media. In other words, scholars who use social media for science-related purposes tend to use social media more in general. In addition, an interest in discovering new ways to share research with public audiences correlated with general use of social media. Holding all other variables at their mean, the likelihood of using social media among scientists who strongly agreed with the statement "I actively seek new ways to use social media to share science and research" was 26 percent higher compared to those who strongly disagreed with the statement.

Next, we examined scientists' use of two popular social media platforms, Facebook and Twitter, for science-related purposes using hierarchical ordinary least squares regression (Table 4). Scholars in communication have found that political ideology influence scientists' attitudes towards science policy (Corley et al. 2009). Others have speculated on the influence of strength of political ideology on media use (e.g., Glynn et al. 2012, Tewksbury and Rittenberg 2012). As online media can quickly become "echo chambers" for ideologues (Sunstein 2007), it is reasonable to extend this expectation to social media, where one's network may be relatively homogenous and where information can be filtered and selected according to partisan leanings. Therefore, we included scientists' strength of ideology in our analysis of Facebook and Twitter use. We found that ideological extremity was related to both Facebook and Twitter use, such that more extreme ideologues were more likely to use the two social media platforms for science-related purposes.[1]

Outside of political ideology, the use of social media for science-related purposes, whether active or passive, predicted Twitter but not Facebook use. Moreover, greater interest in actively seeking new ways to share science significantly predicted use of Twitter, but not Facebook. Taken together, these results may indicate differences in how scholars perceive these social media platforms. Twitter appears to be viewed as a more professional outlet, while Facebook is more likely to be perceived as a space for personal information, and therefore, a less appropriate outlet for circulating research information or for communicating about one's field of study. Another explanation for not using Facebook to share professional work may be the presence and use of other social media

[1] We also re-ran the analysis with political ideology rather than ideological extremity as an independent variable of interest. Political ideology was negatively correlated with Facebook use in the final model of the regression; liberals tended to use Facebook more than conservatives. This finding is consistent with charges from the political right that Facebook has a liberal bias, one that is creating an echo chamber for left-wing thinkers (Munro, 2011). It is also consistent with recent Pew data from the general population showing that ideologically liberal internet users are more likely than their conservative counterparts to engage with social media platforms (Pew Research Center 2012).

that are specifically tailored to researchers. Online communities such as ResearchGate and Academia.edu are both Facebook-like media, but are designed for scientists and researchers to share their work.

Table 3. Model predicting social media use ($N = 227$).

	B (S.E.)
Block 1: Individual characteristics	
Gender (female)	.19 (.40)
Age	-.06 (.02)***
Discipline (biological sciences)	-.57 (.42)
Discipline (physical sciences)	.07 (.45)
Ideological extremity	.16 (.22)
Block 2: Traditional science media use	
Newspapers	.05 (.21)
Television	.01 (.19)
Block 3: Attitudes toward personal social media use	
Active use for science-related purposes	.78 (.26)***
Passive use for science-related purposes	.42 (.19)**
Block 4: Attitudes toward sharing science	
Positive perception of public interest in one's research	.14 (.20)
Actively seeking new ways to share research	.39 (.23)*
Constant	1.10
Log likelihood	-110.24
Nagelkerke R^2 (%)	.40

*$p \leq .10$, **$p \leq .05$, ***$p \leq .01$.

Table 4. Models predicting frequency of Facebook and Twitter use for science-related purposes.

	Facebook ($N = 143$)		Twitter ($N = 143$)	
	Zero-order	β	Zero-order	β
Block 1: Individual characteristics				
Gender (female)	.06	.03	.00	-.03
Age	-.03	-.01	-.21***	-.12
Discipline (biological sciences)	-.02	.08	-.16**	-.03
Discipline (physical sciences)	-.06	.04	.03	.09
Political ideology (conservative)	.19***	.17**	.17**	.16**
Incremental R^2 (%)	—	*4.1*		*8.9***
Block 2: Traditional science media use				
Newspapers	-.22***	.15	.13**	-.01
Television	.08	.07	.00	.04
Incremental R^2 (%)	—	*4.5**		*1.7*
Block 3: Attitudes toward personal social media use				
Active use for science-related purposes	.29***	.18	.48***	.25**
Passive use for science-related purposes	-.16**	-.09	-.29***	-.13*
Incremental R^2 (%)	—	*6.1***		*19.0****
Block 4: Attitudes toward sharing science				
Positive perception of public interest in one's research	.11*	-.06	.31***	.11
Actively seeking new ways to share research	.23***	.10	.42***	.19*
Incremental R^2 (%)		*0.7*		*3.5***
Total R^2 (%)		15.4		33.1

*$p \leq .10$, **$p \leq .05$, ***$p \leq .01$.

While our findings are the product of data collected from one academic institution, they suggest that scientists have started to embrace social media, and Twitter in particular, as a viable tool for communicating their research and staying informed of advancements in their field. While the percentage of scientists using social media for general purposes is still lower than the American public, the percentage who report using Twitter *specifically* for scholarly purposes is more than double that of the general population. The most likely explanation for this discrepancy is that scientists perceive greater value in both disseminating and keeping abreast of scientific research and professional information through Twitter compared to other social media platforms, including Facebook. Indeed, scholars have suggested that many researchers remain wary of the professional value of Facebook, viewing the social media platform as more relevant for staying in touch with friends, family, and acquaintances (Bik and Goldstein 2013).

Scientists' apparent acceptance of Twitter may be a product of the ease by which information can be shared through the platform. Most notably, it is unnecessary for a researcher to "friend" specific individuals in order to have their tweets reach them. Rather, Twitter users can search for content of interest or set up the platform to funnel relevant tweets their way. This means that relevant research information can easily reach even those who do not specifically "follow" the researcher. Perhaps more importantly, although it is not a common occurrence, science topics have "trended" on Twitter in the past. Trending topics are those which are most popular and discussed on the social networking platform. Trending topics are listed on the main Twitter homepage, thus increasing the likelihood that they will be viewed by a large audience of users. In recent years, several science-related topics accomplished this feat. For instance, both the General Meeting of the American Society for Microbiology (Bik and Goldstein 2013) and rumors surrounding the discovery of the Higgs Boson particle (Boyle 2012) trended on Twitter. In fact, the latter issue topped the list of trending topics for June 20, 2012.

Of course, the benefits of Twitter are not a panacea for the ills currently facing science communication. Use of Twitter amongst the general population is growing but is still relatively low. Further, users of both Facebook and Twitter must still self-select into science content. In the case of Twitter, users are still free to ignore trending topics. The

implication of this is that the audiences most likely to encounter shared information about science are those who are already interested in science and related topics. Conversely, skeptics of science and the less informed, who represent audiences that science outreach should be geared toward, may still elude such messages. Moreover, the character limitations imposed by Twitter may make it difficult to adequately communicate complex science to lay audiences. Such restrictions may prove challenging for scientists who are not trained in the techniques of formal science communication with lay audiences.

Nevertheless, social media platforms hold great promise for science communication, interaction with public audiences, and for increasing the productivity of researchers. The findings outlined here suggest scientists are increasingly turning to Twitter to disseminate science information. The implication of this practice is greater science content availability to lay audiences and increased opportunities for scholars to communicate both within and outside their disciplines. Moving forward, greater attention will need to be paid to the impacts which these evolving communication practices will have for science policy formation and public science attitudes.

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