

The Pennsylvania State University

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**ANALYZING EFFECTIVE PREDICTORS OF SCIENTISTS' CONTINUED PUBLIC  
SCIENCE COMMUNICATION MEDIA ENGAGEMENT**

A Thesis in

Media Studies

by

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## ABSTRACT

The way in which university faculty researchers communicate their work to the public has great importance on many levels. Even with this importance, science communication is not universally required and/or recognized as part of employment at institutions of higher education and is not consistently part of the faculty tenure process. This thesis looks to better understand how university faculty researchers' attitudes and experiences with "science media writing" lead to future intended behaviors toward media writing. By analyzing survey data from university faculty researchers who are authors of not-for-profit news media website The Conversation, this thesis explores the impact of scientists' participation in media outreach and identifies the attitudes and experiences of scientists who participate in science communication (via writing an article for The Conversation) that lead to intended behavior, specifically recommending the writing experience to a colleague. This thesis shows that two-way online engagement via responding to reader comments and social media as well as experiencing professional outcomes – such as increased scholarly article citations, being approached for academic collaborations and requests for interviews by news media – lead to greater media outreach intentions.

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## **Introduction**

Science communication and the relationship between scientists – referred to as university faculty researchers throughout this thesis – and journalists has been a focus of research for some time (Friedman, Dunwoody and Rogers, 1986; Peters, 1995; Valenti, 1999).

As media and political environments have changed, so has science communication. Nisbet and Markowitz (2016) emphasize the increasing importance of communicating research to the public through strategic goals like correcting false information as areas like climate change and food biotechnology have become politicized in the U.S. and around the world.

Druckman (2015) asserts that as the public turns away from new information or knowledge and increasingly makes decisions based on social, political, moral, and/or religious values, universities and scientific organizations must counter this science communications challenge by collectively engaging the public and policymakers through active mass-media outreach to publicize research-based facts.

Various global calls to action have been issued by others over the past few decades for university faculty researchers to increase broad communication about their research to general public audiences (Cicerone, 2006; The Royal Society, 2006; Jia & Liu, 2014; Holt, 2015; and National Academies of Sciences, Engineering, and Medicine, 2016). For example, the European Union in 2002 commissioned a “Science and Society Action Plan” in order “to pool efforts at European level to develop stronger and more harmonious relations between science and society” (European Union, 2002, p. 3).

Similarly, the public relations departments at many colleges, universities, and research institutions – large or small, public or private, across the globe – have dedicated resources toward promoting faculty experts and their published research. In fact, many universities have



websites created to feature faculty work and share potential experts with journalists for interviews.

A few examples include Columbia University (“Columbia University Experts Guide,” 2018), American University (“Faculty Experts Guide for News Media,” 2019), Northern Illinois University (“Experts Guide,” 2019), Rutgers University (“Media Guide to Faculty Experts,” 2019), Boston University (“Faculty Experts,” n.d.), UCLA (“Media Guide to UCLA Experts,” 2019), Monmouth University (“Expert Guide,” 2019), University of Nottingham (“Expertise Guide,” n.d.) and University of Sydney (“Find an Expert,” 2013).

One particularly important area of public relations outreach for universities is science communication. The American Association for the Advancement of Science (AAAS) defines science outreach and public engagement “as intentional, meaningful interactions that provide opportunities for mutual learning between scientists and members of the public,” (Nisbet and Markowitz, 2016).

Universities also invest resources into placing faculty op-eds – even creating their own syndicated op-ed services with media distribution like Duke University, North Carolina University and Elon University (Lawrence, 2013).

Many universities also invest in partnerships with media-related science communications projects meant to connect faculty with the media. Examples of these organizations include not-for-profit and nonprofit groups like The Conversation (<https://theconversation.com/us>) and The OpEd Project (<https://www.theopedproject.org/>) – which help facilitate placement of university faculty researcher-written articles in media outlets – and for-profit businesses like ExpertFile (<https://expertfile.com/>) and Help a Reporter Out (<https://www.helpareporter.com/>) – databases

of expertise profiles meant to elevate university faculty researchers as thought leaders in the media and to connect them with journalists looking for sources.

The Conversation, which will be a focus of this thesis study, is a global network of newsrooms, first opened in Australia in 2011. The organization launched its U.S. newsroom in 2014. Today, it also publishes in Canada, the United Kingdom, France, Indonesia, Africa and Spain. With the tagline “academic rigor, journalistic flair,” the organization employs a new model in which university faculty researchers write articles for the media in their area of expertise by collaborating with seasoned journalists, who fill the editor role. A media outreach team then shares the articles with media republishers – ranging from small-town newspapers to top-tier national and international media outlets – via a Creative Commons license. Under this model, university faculty researchers have more control over their narratives because they have the final approval before their articles publish, and, as part of the Creative Commons license, media republishers can’t edit the articles without the authors’ permission.

Keith Lawrence, director of media relations at Duke University, wrote in 2013 that “by plugging your faculty members into the op-ed market, you can help them extend their voices beyond your campus and raise their profiles – and your institution’s – at the same time” (Lawrence, 2013, p. 51).

While universities receive reputational value from public communication of research, more research is needed to understand the motivations for university faculty researchers to communicate their science to the public, especially since there is still a disconnect between many universities’ stated commitments to public communication and a lack of value and recognition for this work in tenure processes (Woolston, 2018). Without this direct promotion benefit, more

research is also needed to better understand the other possible benefits that university faculty researchers may receive from communicating science through media outreach.

The purpose of this thesis is to understand how attitudes and experiences with “science media writing” lead to university faculty researchers’ future intended behaviors toward media writing. This thesis will analyze survey data from authors of *The Conversation* to explore the impact of university faculty researchers’ participation in media outreach and identify the attitudes and experiences of university faculty researchers who participate in science communication (via writing an article for *The Conversation*) that lead to intended behavior, specifically recommending the writing experience to a colleague. This thesis will explore the impact of experience, professional outcomes, and engagement on this future intended behavior.

## Literature Review

One of the core fundamental roles of an organization's public relations arm is media relations – a relationship that has evolved significantly over time as newsroom reductions and social media have changed the journalism industry (“PR Industry Fills Vacuum Left by Shrinking Newsrooms,” 2011).

Bajkiewicz, Kraus, and Hong (2011) write that PR professionals are “doing less traditional media relations, mostly attributable to downsized newsrooms, and frustration with the resulting dearth of institutional knowledge, influx of young, inexperienced reporters, and shallow stories” (p. 329). The authors add that while PR practitioners may have an easier time injecting verbatim information into news stories because of these conditions, they also value their relationships with reporters and are using tools like social media to communicate with journalists to help maintain those relationships (Bajkiewicz, Kraus, and Hong, 2011).

Additionally, Waters, Tindall and Morton (2010) further explain how the evolving media environment has changed the journalist-public relations practitioner relationship and traditional communications patterns, impacting the way in which journalists find their expert sources. With less journalism resources, the source-reporter relationship is now closer than ever, and journalists are now requesting information from PR practitioners in a trend that researchers call “media catching.”

They write that “rather than having practitioners contacting lots of journalists, broadcasters, and bloggers in hopes of gaining media placements, thousands of practitioners are being contacted at one time by journalists and others seeking specific material for stories, blog postings, and Web sites with upcoming deadlines” (Waters, Tindall and Morton, 2010, p. 243).

Shortly after, Tallapragada, et. al. (2012) showed that the media catching trend is growing and identified best practices for PR practitioners when using media catching websites.

Macnamara (2014) found in an in-dept qualitative study that while seasoned journalists and PR professionals support independence for a healthy media ecosystem, evidence is beginning to show the convergence of the two practices, particularly when new types of social media and sponsored media content blur the lines between the two practices. Additionally, his research confirmed that the Jeffers Syndrome – the finding by Jeffers (1977) that showed that journalists are more favorable to PR practitioners they know personally – and expanded the idea to show that journalists today tend to rely heavily on a “circle of experts” (Macnamara, 2014, p. 748).

In fact, the changes in the journalism industry have been so significant that Lee, Yip and Chan (2018) proposed a new public relations theoretical model called press engagement behavior (PEB) to “explain the context of journalist engagement, enriching the operational value of cultivation strategies in dyadic relationship settings” (Lee, Yip and Chan, 2018, p. 490).

Instead of viewing journalists and PR practitioners as separate entities in separate fields, the PEB model – based on other PR theory like cultivation strategies in organization-public relationships studies and the two-way symmetrical model in excellence theory – looks at how journalists respond to PR practitioners “in co-creating value for their audiences” (Lee, Yip and Chan, 2018, p. 490).

Scientists are often at the center of this “co-creation” of media, whether they are being quoted on their expertise in an article written by a journalist, mentioned in a press release written by a public relations professional, or are writing about their own research and expertise – as will be the focus of this study.

## **Theory of Planned Behavior**

This thesis will build upon past studies of university faculty researchers' intended behavior and add to research on science communication by faculty at academic institutions across the world. The Theory of Planned Behavior (TPB) in particular has been widely used in several fields of study to explain science communication and health-related behaviors, for example, and has also received some criticism, including its actual utility (Sniehotta, Presseau and Araújo-Soares, 2014) and its primary focus on rational reasoning without taking into account emotions, including negative attitudes, outside of the anticipated outcomes (Conner, Gaston, Sheeran and Germain, 2013) or unconscious influences on behavior, such as impulsive and reflective processes (Sheeran, Gollwitzer and Bargh, 2013). A main criticism has been the limited predictive validity of the TPB because it has failed to account for the reality of "inclined abstainers" – individuals who report an intention but do not act upon it as anticipated (Orbell and Sheeran, 1998).

Taking this criticism into consideration, this thesis will study the attitudes and experience of university faculty researchers who have all already participated in science communication and who have had a similar shared experience via writing for the same news organization.

## **Public Communication**

In science communication, the term public communication can have varying definitions. Scholars have studied broad citizen engagement in public life (Delli Carpini, Cook and Jacobs, 2004) as well as risk and science communication (Besley and McComas, 2014).

Burns, O'Connor and Stocklmayer (2003) defined "the use of appropriate skills, media, activities, and dialogue" in science communication to produce one or more of the following

outcomes: awareness, enjoyment, interest, opinion forming and understanding – otherwise known as the “AEIOU vowel analogy.”

Hu et al. (2018) describe a two-stage public engagement process, which considers social proof (does a university faculty researcher’s peers approve of the engagement) and meaning (is the engagement beneficial other groups) as two factors that impact university faculty researchers’ decisions to participate in public engagement. These factors can also be split into “in-group” and “out-group” meanings. And Besley, Dudo and Yuan (2018) identify the long-term “goals” and short-term “objectives” that science communication can accomplish.

Some science communication scholars have found that university faculty researchers have a fairly narrow view of science communications, with the primary goal of educating the public (see Burchell, 2015 and Dudo and Besley, 2016).

Other scholars, though, have studied science communications training as a tool for university faculty researchers when communicating with the public and found university faculty researchers’ goals to be broader. Besley, Dudo and Storksdieck (2015) found that university faculty researchers have five main objectives for communicating their research – increasing understanding; increasing perceptions of trust; demonstrating listening; demonstrating caring; framing.

Similarly, Besley, Dudo and Yuan (2016) found that science communications trainers – those teaching communications skills to scientists – have four primary goals: building knowledge; fostering excitement; building trust; and reframing issues.

Belsey and Nisbet (2013) showed that university faculty researchers believe the public, being generally uninformed, is prone to errors in judgement and that policy-makers are the most

important public group to engage. Treise and Weigold (2002) also specifically call out science communication as a means to creating favorable attitudes toward policy makers.

Public deliberation scholars have also studied broad public discourse, citizen engagement and “democratic engagement” as meaningful, multiparty dialogue (Delli Carpini, Cook and Jacobs, 2004).

### **Two-Way Communication**

In their “Public Engagement Research and Major Approaches” bibliography commissioned by the AAAS, Nisbet and Markowitz (2015) identified three key approaches to university public engagement through university faculty researchers’ science communication efforts – university-led cooperative engagement approaches through collaboration with key stakeholder groups; public dialogue approaches; and knowledge co-production approaches – which all emphasize “two-way iterative dialogue involving experts, the public, and stakeholders” (Nisbet and Markowitz, 2015, p.3).

This approach closely mirrors the two-way symmetrical process in public relations theory, as described early on by Grunig and Grunig (1992), in order to achieve dialogic communication outcomes with key public stakeholders, as proposed by Kent and Taylor (1998).

While a lot of media outreach initiatives can be one-way in nature, this thesis will explore the impact of participating in two-way communication on science communications by university faculty researchers’ intended behavior after engaging in a two-way communication with the public, specifically his/her media audience.

### **Science Communication and Intended Behavior**

Many recent studies have treated public engagement as planned behavior, pulling from the Theory of Planned Behavior (TPB) (Ajzen, 1985). Beyond the demographic predictors that



will be described later in this literature review, the use of the TPB is consistent with other past science communication research into predictors of scientists' behavioral intent (Poliakoff and Webb, 2007) and willingness to engage (Besley et al., 2018) that study three variables drawn from the TPB – attitude, subjective norms, and perceived behavior control, sometimes referred to as efficacy (Aizen, 1991 and Aizen, 2019).

Under the TPB, the likelihood that a behavior will occur is directly related to behavioral intentions, defined as one's motivation to engage in a behavior (Breslin et al., 2001). Poliakoff and Webb (2007) found that efficacy in particular was a significant predictor of intention to engage in communication. Consistent with TPB, the researchers also found respondents' past engagement behavior (efficacy), views about engagement itself (attitude), and the belief that other university faculty researchers were engaging (social norms) as significant variables.

More recently, Besley et al. (2018) looked at university faculty researchers' "willingness" to participate in science communication. They found that enjoyment of experience (attitude), making a difference (response efficacy), and time were most consistent predictors of university faculty researchers' willingness to participate.

Beyond the TPB, other models have looked at intended behavior. Under the Theory of Reasoned Action (TRA), the level that a behavior is performed is mainly determined by the degree to which a person intends to perform it, and that intention is formed by attitude and subjective norm (i.e. one's perception of what his or her peers will think about the behavior) (Ajzen and Fishbein, 1980 and Fishbein & Ajzen, 1975). Fishbein combined variables of the TRA with the Health Belief Model (Rosenstock, 1974) and Social Cognitive Theory (Bandura, 1977) to form the Integrative Model of Behavioral Prediction. Under the Integrative Model of Behavioral Prediction, "any given behavior is most likely to occur if one has a strong intention to

perform the behavior, and if there are no environmental constraints preventing behavioral performance” (Fishbein and Yzer, 2003, p. 166). These models and their variables are commonly used in science and environmental communications as well as health communications (see Poliakoff and Webb, 2007 and Glanz, Rimer, and Viswanath, 2008).

As identified above, a common variable in many of these intended behavior models is subjective norm or normative beliefs. In a recent study of science communication scholars’ and natural scientists’ views on science communication, Yuan, Besley and Dudo (2019) found that while communication scholars expect more public engagement from scientists than what scientists actually perform, scientists see the science community’s norms as more positive in regard to public engagement than communication scholars. According to the authors, the findings “might signal that communication scholars may underestimate the normative support scientists perceive from colleagues when they engage” (Yuan, Besley and Dudo, 2019, p. 115).

Because of the previously identified strong influence of social norms among university faculty researchers and their colleagues, this study uses the intention of recommending the science media writing experience to a colleague as a strong indication of interest and support for the behavior. Based on literature on two-way communication and intended behavior, the following research is proposed.

***RQ1:** Does two-way engagement online lead to greater intention to recommend science media writing to a colleague?*

### **Demographics of Science Communications**

As a means for measuring and predicting reasons that scientists choose to participate in science communication, scholars have also looked at demographic information, including field of study, gender, and age (Torres-Albero et al., 2011).

Past studies have shown that older university faculty researchers are more likely to engage in science communication than younger university faculty researchers (Bentley and Kyvik, 2011 and Besley, Oh and Nisbet, 2013) except for online engagement, which found opposite results (Rainie et al., 2015 and Besley, 2014). Besley et al. (2018) also found that while middle-aged university faculty researchers are the most willing to engage through news media, younger university faculty researchers are more willing to engage online. Based on these findings, the following hypothesis based on university faculty researchers' ages is proposed.

***H1:** Younger university faculty researchers are more likely to participate in two-way online communication with article readers.*

Additionally, Besley, Oh and Nisbet (2013) found that while female scientists appear to believe media engagement is more important than male scientists; male scientists are more willing and more likely to engage in media. Other studies have also found that men are more willing to engage in science communication (Bentley and Kyvik, 2011 and Besley, 2014). These and other findings (Torres-Albero et al., 2011 and Besley et al., 2018) based on scientists' age and gender demographic information lead to the second research question of this thesis.

***RQ2:** To what degree do age and gender influence intention to recommend science media writing to a colleague?*

### **Interaction with the Media**

When it comes to media engagement specifically, Besley and Nisbet (2013) found that while university faculty researchers tend to be critical of media coverage, they generally report their personal experiences interacting with media to be favorable and believe that participating in science communication via media coverage will positively impact promoting public science literacy and advancement of their individual careers. This supported earlier findings that also

found university faculty researchers' experiences with journalists to be generally positive (Peters et al., 2008). Building upon these findings, a second hypothesis is put forward.

*H2: University faculty researchers who had a positive attitude toward their experience with science media writing are more likely to intend to recommend it to a colleague.*

### **Measurement of Media Outcomes**

Beyond the changes in the interactions of public relations practitioners, journalists and university faculty researchers, the manner in which these interactions are valued and measured is changing.

A great body of public relations research and theory has been based on Grunig and Hunt's (1984) four models of public relations: press agency, public information, two-way asymmetrical and two-way symmetrical community. And evaluation of the public relations function of many organizations have historically been measured by the tangible number outcomes of these models, such as news article mentions and news organization circulations. Even with the emergence of social media, a focus on numerical impact through follows, likes, retweets, and reach is still used today. More recently, though, as relationship management public relations theory has developed, ways to evaluate those relationships have also emerged (Lindenmann, 1999).

Hon and Grunig (1999) attest that "in addition to short-term measures of public relations processes and outcomes, public relations professionals need indicators and measures useful for identifying, maintaining, and evaluating longer-term relationships – for environmental scanning of strategic publics, of successful strategies for maintaining relationships, and for outcome indicators of the quality of relationships" (Hon & Grunig, 1999, p. 38).

Interestingly, though, there still seems to be a disconnect between university missions, reputation, and faculty expectations (Woolston, 2018 and Flaherty, 2016). While the impact that media relations professionals assisting university faculty researchers in media outreach is tracked and measured, and most universities, especially public institutions, place importance on service to society and university communities, science communication isn't consistently part of the faculty tenure process. Beyond the broader public engagement goals of educating the public, demonstrating trust and framing issues described above, what are other more beneficial reasons that university faculty researchers choose to participate in science communication?

This study will look at other potential means of measuring media impact, including tangible outcomes experienced by university faculty researchers participating in science communication – like collaborations, increased citations, and funding support – and how those outcomes may impact researchers' future intentions to engage in science communication via the TPB variables of efficacy (what impact/outcomes did writing for *The Conversation* have on university faculty researchers' work), social norms (are university faculty researchers who have written for *The Conversation* willing to recommend it to a colleague), and attitude (how satisfied are university faculty researchers with their experience writing for *The Conversation*). While each professional outcome can be studied individually based on qualitative study of open-ended survey questions answered, a final general research question is proposed.

***RQ3:** To what degree do professional outcomes lead to increased intention to recommend science media writing to a colleague?*

## **Methodology**

### **Design Overview**

This research provides secondary data analysis of a large-scale survey of university faculty researchers who have participated in science communication by writing an article for the not-for-profit media website, The Conversation.

While much of the Theory of Planned Behavior literature, as detailed above, has focused on predictors of engagement, my study through quantitative evaluation of a survey of university faculty researchers will focus on outcomes of engagement. Secondary qualitative analysis of an open-ended survey question will also be used to further study these results. This preliminary study looks at these outcomes as a proposed feedback loop for further engagement predictions – in the form of university faculty researchers’ satisfaction and intent to recommend the experience to a colleague (which plays into the social norms variable of the TPB). These preliminary outcome results will be based on a survey of university faculty researchers who have already participated in public communication – they have all written for The Conversation.

### **Participants**

Participants for this study include university faculty researchers from across the U.S. and internationally who have written for The Conversation, and therefore have participated in public communication in the form of science media writing.

In spring/summer 2018, The Conversation emailed a survey to all readers, university faculty researcher authors, and media republishers who have participated in public outreach via its website platforms. The 41-question survey was divided into three role sections – readers, authors, and media republishers – and participants were given questions related to the role(s) for

which they identified. A total of 552 university faculty researcher authors, 2,136 readers, and 154 media republishers participated in the survey.

This study will focus on the university faculty researcher author questions (see the Appendix), which were answered by university faculty researchers who have written for The Conversation and included questions around author experience, outcomes, behavior, and demographics. Only authors are being used since the focus of this thesis study is on capturing the experience of university faculty researchers who have participated in media outreach.

Of the authors who answered demographic questions, 58% were male, 40% were female and 2% selected “prefer not to answer.” Additionally, the breakdown of author age was 15% aged 25-34; 26% aged 35-44; 22% aged 45-54; 20% aged 55-64 and 17% 65 and older, as visualized in Table 1 below.

Table 1: Demographic Breakdown for Conversation Survey Participants by Age.

	Frequency	Percent
18-24	1	.3%
25-34	45	14.4%
35-44	80	25.6%
45-54	71	22.7%
55-64	62	19.8%
65 and older	54	17.2%
Total	313	100

Table 2: Demographic Breakdown for Conversation Survey Participants by Gender.

	Frequency	Percent
Female	124	39.6%
Male	181	57.8%
Prefer Not to Answer	8	2.6%
Total	313	100

It's important to note that because of the design of the survey, only respondents who identified both as an author and as a reader of *The Conversation* – a total of 313 respondents – answered the demographic questions, as the questions were located under the “reader” portion of the survey.

## **Measures**

*Attitude toward experience.* Attitude refers to the author's “overall perception of favorableness or un-favorableness toward a behavior” (Glanz, Rimer, and Viswanath, 2008). This study will look at university faculty researchers as authors and gauge their attitude toward their experience of science media writing. University faculty researchers who have written an article for *The Conversation* were asked a yes/no question about whether they had a positive experience working with the editor(s) at *The Conversation*. This will be used to evaluate experience.

*Professional outcomes.* For the purpose of this study, “professional outcomes” can be defined as personal career benefits for university faculty researcher authors resulting from their participation in science media writing. Survey questions ask authors to choose as many professional outcomes from a list that apply to their experience. These “professional outcomes” refer to outcomes that could help advance university faculty researchers' professional standings or careers. The potential outcome choices include additional media requests (by radio, TV or print outlets), increased citations of scholarly articles, use of the article or metrics as part of grant or other funding opportunity, academic collaborations, influencing a policy maker or being asked to write another article or other book/publishing opportunity. These outcomes will all be evaluated as a single variable, but then will be evaluated as separate professional benefits in discussion. Qualitative analysis of an open-ended option as well as of a second question (asking



“Anything else we should know about your experience of working with The Conversation?”) also explored other potential author experiences to include in evaluation.

*Two-Way Online Engagement.* Under Grunig’s Excellence Theory, the two-way symmetrical model “proposed that individuals, organizations, and publics should use communication to adjust their ideas and behavior to those of others rather than try to control how others think and behave” (Grunig, 2006, p. 156). This study extends that two-way communications model to online engagement between university faculty researcher authors and readers. Engagement is measured via the university faculty researchers’ reported use of his or her author dashboard. One survey question asks authors to check from a list of uses all that apply. Two potential use options involve two-way communication. They include monitoring and responding to comments and monitoring and responding to tweets or other social media. Analysis of university faculty researchers’ two-way engagement was captured through three levels of engagement using a continuous variable of 0, 1, and 2 (representing none, one or two two-way engagement experiences).

*Behavior intentions.* Breslin et al. (2001) define behavior intentions as “one’s motivation to engage in a behavior,” which in this case consists of recommending a colleague participate in science media writing (Breslin et al., 2001, p. 424). In another question, university faculty researchers were asked on a five-point scale how likely they were to recommend to a colleague that they write for The Conversation. This intended behavior will serve as the predicted resulting variable outcome being determined by the engagement, professional outcome, experience, and demographics measures.

*Demographics.* The Conversation’s survey of university faculty researcher authors asked participants to provide their age (based on six 10-year, incremental ranges) and gender. As

referenced above, this is consistent with previous studies about university faculty researchers' participation in science communication (Besley, Oh and Nisbet, 2013 and Besley, 2014). For several analysis tests, a high/low age variable was created by grouping the bottom three and top three age-range choices.

It is important to note that demographic information was only collected for university faculty researchers who identified as both an author and a reader. Not all authors of The Conversation also self-identified as readers. Of the 552 author respondents, 309 – or about 56 percent – also identified as readers and answered the demographic questions. The survey design that resulted in this demographic collection will be addressed below in “limitations.”

Additionally, it is important to note for this particular study that while academic rank was not part of the demographic analysis, the average age that a faculty member receives tenure in the United State is 39 (European University Institute, 2018). It is dually important to note that while many of the survey respondents were U.S. university faculty researchers, this was a global study of all The Conversation's website locations and included responses from university faculty researchers from around the world, where academic career advancement timelines may vary.

### **Coding and Interpretation**

As noted above, the analysis of the survey data also included a qualitative look at two open-ended questions that gave authors the option to share an open-ended response about professional benefits and asked “Anything else we should know about your experience of working with The Conversation?” The coding and analysis of these questions followed the process of theme development and iterative code identification (Neale, 2016 and Thurman, 2018). As the answers to each question were read, emergent themes were identified based on elements the researcher deemed to be repeated across answers. Any answers that were repeats of

other listed options in the “check all that apply” list of benefits or were internal to The Conversation (for example, comments on personalities of editors or processes internal to the organization) were eliminated. Once the top themes were selected, the answers were color-coded in an excel document.

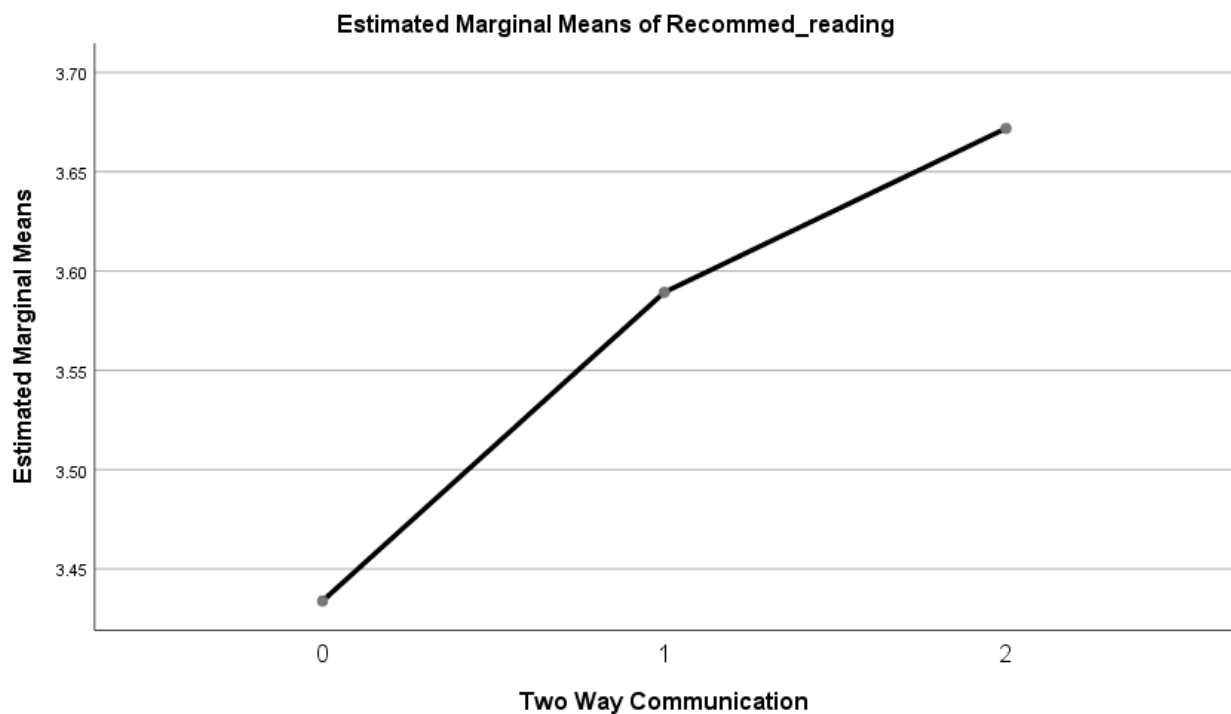
The emergent themes included: *increased visibility in field, social media shares, speaking engagements, used for promotion/institution recognition, used in teaching, and more attention to work than in peer-reviewed journal*. Two final categories, while not professional benefits, were identified because of the implication on potential impact on intention to recommend to a colleague. They are ability to *control spin* and *no pay for the work*. These emerging categories along with the professional benefit “select all that apply” options give additional context for further analysis, especially for research question 3.

## Results

### Research Question 1

Research question 1 aimed to see if two-way engagement online leads to greater intention to recommend science media writing to a colleague. To explore this question, a univariate ANOVA was run with intention to recommend as the dependent variable and two-way engagement as the fixed factor. Results support the notion that increased two-way engagement leads to higher intention to recommend,  $F(2, 312)=3.51, p<.05$ .

Figure 1: Univariate ANOVA comparing the effect of two-way engagement on university faculty researchers' intention to recommend science writing to a colleague.



### Hypothesis 1

Hypothesis 1 aimed see if younger university faculty researchers are more likely to participate in two-way online communication with article readers. A chi-square test of independence was performed to examine the relation between age and two-way online

communication. The relation between these variables was significant,  $X^2(1, N = 309) = 25.136$ ,  $p = .000$ . Young participants were more likely to engage in two-way online communication. H1 was supported.

Additionally, a crosstabulations analysis of these results (see Table 3 below) show that younger university faculty researchers are more likely to use more variations of two-way online communication (in this case, report responding to comment and responding to social media).

Table 3: Crosstabulations of university faculty researchers who reported two-way experience.

		Reported no Two-Way Experiences		Reported 1 Two-Way Experience		Reported 2 Two-Way Experiences		Total	
		n	%	n	%	n	%	n	%
Age of University Faculty Researchers and older	18-24	0	0%	0	0%	1	100%	1	100%
	25-34	16	35.6%	10	22.2%	19	42.2%	45	100%
	35-44	34	43.6%	22	28.8%	22	22.8%	78	100%
	45-54	26	37.1%	29	41.4%	15	21.4%	70	100%
	55-64	32	50.8%	27	42.9%	4	6.3%	63	100%
	65 and older	26	50.0%	24	46.2%	2	3.8%	52	100%
Total		134	43.4%	112	35.2%	63	20.4%	309	100%

### Research Question 2

Research question 2 aimed to see to what degree age and gender influenced intention to recommend science media writing to a colleague. An independent sample t-test showed no significant difference between younger university faculty researchers ( $M=4.71$ ;  $SD=.736$ ) and older university faculty researchers ( $M= 4.56$ ;  $SD= .806$ ),  $t(306)=1.692$ ,  $p= .092$ . However, as noted above, the age categories were made into a high/low variable, and the ability to split the

age categories into two variables constituted a 40% (younger) and 60% (older) split, which could have impacted results.

However, an independent sample t-test on gender was significant, with female university faculty researchers ( $M= 4.73$ ;  $SD= .723$ ) more likely to recommend science media writing to a colleague than male university faculty researchers ( $M= 4.56$ ;  $SD= .808$ ),  $t(301)= 1.977$ ,  $p= .049$ .

Because the results of this gender t-test were significant and research question 3 about professional outcomes (below) was shown to be significant, an additional t-test was conducted for gender and reported professional benefit outcomes. The t-test was nearly significant with male university faculty researchers ( $M= 2.61$ ;  $SD= 1.990$ ) being likely to report more professional outcome experiences after science media writing than female university faculty researchers ( $M= 2.18$ ;  $SD= 1.839$ ),  $t(303)=-1.937$ ,  $p= .054$ .

## Hypothesis 2

Hypothesis 2 aimed to see if university faculty researchers who had a positive attitude toward their experience with science media writing would be more likely to report intention to recommend the experience to a colleague. A correlation test showed that there was a strong positive correlation between participants who reported a positive experience and intention to recommend science media writing to a colleague,  $r= .611$ ,  $n= 453$ ,  $p= .000$ . H2 was supported.

Table 4: University faculty researchers who had a positive experience, rated on a 5-point scale.

	Frequency	Percent
Strongly Agree	313	57
Agree	100	18
Neither Agree nor Disagree	24	4
Disagree	14	3
Strongly Disagree	6	1
Did Not Answer	95	17
Total	552	100

Frequencies were run for the positive experience question to better understand the breakdown of university faculty researchers' experiences with science media writing (see table 4 above). Some of the qualitative analysis shed additional light on the experience. For example, this comment by a female university faculty researcher between the ages of 25 and 34 years old summed up many of the positive open-ended comments from the "Anything else we should know about your experience of working with The Conversation?" question:

*"It was a great experience and taught me how to write for a different audience. It's also excellent that the articles are published under a CC license so they can be republished elsewhere."*

This comment by a female university faculty researcher between the ages of 35 and 44 also echoed the sentiment, expressing intention to share with colleagues:

*"It was an absolute pleasure working with the editors and writing for the Conversation. I have encouraged colleagues to get in touch and write."*

This comment by a female university faculty researcher between the ages of 55 and 64 shows intention for continued media outreach:

*"This is a truly fabulous forum/outlet/service. I had wonderful experiences working with the editors and hope to get back to writing some other articles during the summer. Many thanks for the great work that you and the Editors do!"*

Finally, this comment from a male university faculty researcher between the ages of 25 and 34 expresses a different, but nonetheless positive experience with the science writing experience, hinting at trust for the media outlet and ability to control spin – one of the open-ended analysis categories, outlined in discussion below:

*“The greatest justices afforded by The Conversation to its authors is are transparency and involvement in the editorial process. I’ve since had final edits sully my articles at publication with other outlets, and so I’m grateful for the shared editor-author platform used by The Conversation.”*

**Research Question 3**

Research question 3 aimed to see if reported professional outcomes experienced after science media writing lead to increased intention to recommend science media writing to a colleague. A correlation test showed that there was a strong significance between reporting of professional outcomes and intention to recommend science media writing to a colleague,  $r = .250, n = 447, p = .000$ .

Frequencies were run to better understand the amount of professional benefits reported by university faculty researchers, both through the quantitative “check all that apply” questions (see Table 4 below) as well as for the qualitative analysis of professional benefits reported in the open-ended questions (see Table 5 below).

Table 5: Professional benefits to science media writing reported by university faculty researchers on The Conversation survey’s “Choose all that apply” questions.

	Frequency	Percent
Increased Citations	113	10.9
Used for Grant/Funding	85	8.2
Academic Collaborations	157	15.2
Influenced Policy	51	4.9
Radio Opportunity	229	22.2
TV Opportunity	75	7.3
Print Opportunity	171	16.6
Other Opportunity to Write	122	11.8
None	30	2.9
<b>Total</b>	<b>1033</b>	<b>100</b>



Table 6: Professional benefits and other impacts of science media writing reported by university faculty researchers on The Conversation survey’s open-ended question.

	Frequency	Percent
Increased Visibility	16	28.5
Promotion/Recognition	17	30.3
Social Media Shares	8	14.3
Speaking Engagements	3	5.4
Used in Teaching	5	8.9
More Attention Than Journal	2	3.6
Control Spin	2	3.6
No Pay	3	5.4
Total	56	100

As shown above, the qualitative analysis of the open-ended answers showed eight more categories. These were categorized as Increased visibility/networking in field of study; Social media shares; Speaking engagement opportunities; Used for promotion/tenure or other department/institution recognition of public engagement; Used in teaching; More attention to my work than in peer-reviewed journal – and two other categories that are not necessarily professional benefits, but can impact the decision to participate in science media writing – Control spin and Large time commitment/no pay.

The two highest reported professional benefits in the analysis of open-ended answers by author respondents were Used for promotion/tenure or other department/institution recognition of public engagement and Increased visibility/networking in field of study. Below are some examples of author comments selected as a representative of the comments analyzed that provide further insight into authors’ benefit professional benefits experiences.

A female university faculty researcher, between the ages 55 to 64, commented:

*“At work they value having our work cited and my articles for the Conversation have been picked up by other outlets, which my college values.”*

While tenure wasn't specifically mentioned in this comment, a female university faculty researcher between the ages 35 to 44 said:

*"I have used the piece in my own promotion files at my institution, and that has been valued by my institution."*

And, more specifically, a male university faculty researcher between the ages 45 to 54 said:

*"Contributed to my being granted rank of Professor."*

Beyond institution recognition and/or used in the promotion and tenure process, several university faculty author respondents commented on general increased visibility in their field. Of note, as will be mentioned for future research below, the majority of respondents who commented on the increased visibilities in their fields happened to be female, but the respondents represented a wide range of ages.

For example, a female university faculty researcher between the ages of 25 to 34 said generally about reach:

*"More attention to the work on Twitter. Much more reception of the ideas than through the journal article on which the Conversation piece was based."*

And a female university faculty researcher between the ages of 25 to 34 shared specifically about visibility in her field of study:

*"More people viewed the article which should lead to an increased likelihood of citation. It drew more attention to my work at a national and international level. I also increased my visibility in the discipline as a junior scholar."*

Additionally, a female university faculty researcher over the age of 65 commented about different types of measurement:

*“My article generated a great deal of attention. In my field citations aren't really measured.”*

Another female university faculty researcher over the age of 65 also shared:

*“The article in The Conversation reached a large number of readers among the general public and increased interest in a very broad area of scientific research. Publishing in The Conversation was an enormous benefit and advanced my research program substantially.”*

A male university faculty researcher between the ages of 45 to 54 commented on his reach as well as his science media writing experience's impact on his teaching:

*“I use the conversation to write about topics that I find interesting and that I use in my teaching, but not necessarily topics that I have published about in scholarly contexts. It is for me a tool to widen my footprint.”*

While there are signs that universities and certain academic fields are beginning to value science media writing, as evidenced by the university faculty researchers' comments on tenure promotion and academic visibility above, a few respondents commented on the time commitment and lack of compensation that comes with science media outreach.

One university faculty researcher who did not answer the survey's demographic questions explained the discrepancy:

*“My colleagues and I are encouraged to place ‘significant works in public media,’ preferentially at THE CONVERSATION, but ‘significant’ means well reasoned (sic), well supported, and well written. We work hard to produce what you call ‘content,’ which we then give you for free to use however you choose.”*

Another respondent who also did not answer the survey’s demographic questions simply answered:

*“Pay your authors!”*

Additionally, a full regression model was run to further explore how well professional benefits and other variables predicted university faculty researcher intentions. Although age was established not be a factor in predicting intention to recommend, as reported in the above results, the researcher regressed intention to recommend science writing to a colleague on all variables, including gender, professional outcomes, positive experience, two-way engagement and age. All the variables except age were significant or approaching significance (see table 7 below).

Table 7: Regression analysis table predicting intention to recommend science media writing to a colleague.

Source	B	SE B	$\beta$	t	p
Gender	-.166	.076	-.105	-2.179	.030
Professional Outcomes	.038	.020	.093	1.867	.063
Positive Experience	.521	.047	.540	11.146	.000
Two-Way Communication	.088	.051	.086	1.742	.083
Age	-.010	.029	-.017	-.341	.733

## Discussion

### Summary of Findings

There are pros and cons that come with using survey data from an independent organization in lieu of creating and conducting one's own survey. One benefit of the survey used in this research is the fact that all of the university faculty researchers who authored articles for The Conversation share a similar media outreach experience from which the survey is drawing questions. Since science communication and public outreach can vary greatly and create many different experiences, these survey results are unique in that they give a glimpse into the various thoughts of university faculty researchers who have had a shared experience.

Results from the analysis of this survey shed some light into these experiences – showing that a positive experience, gender, two-way engagement online and reported professional benefits all lead to increased intention to recommend science media writing to a colleague.

Of the surveyed university faculty researchers who have written for The Conversation, 313 – or 57% – strongly agreed with the statement that they had a positive experience writing for The Conversation, as shown by table 4 above. Not surprisingly, hypothesis 2 supported the idea that university faculty researchers who had a positive attitude toward their experience with science media writing are more likely to intend to recommend it to a colleague. This adds to previous studies that have shown that university faculty researchers generally report their personal experiences interacting with media to be favorable (Besley and Nisbet, 2013) but also shows that the favorability can lead to intention and further interaction.

The finding also has implications for university public relations offices and journalists alike when building relationships with university faculty researchers in that positive experiences could assist with university reputation building via university faculty researchers' continued and

even increased participation in media outreach and the availability of university faculty researchers as a pipeline of expertise to tap into for interviews in the future, respectively.

### **Implications for Two-Way Communication**

Research question 1 and hypothesis 1 both supported and added to past science communication research on age and two-way communication (Rainie et al., 2015; Besley, 2014; Besley et al., 2018), showing that not only are younger university faculty researchers more likely to participate in two-way online engagement and that the younger a university faculty researcher is, the more likely he or she was to participate in two-way online, but also that two-way online engagement leads to greater intention to recommend science media writing to a colleague.

As will be addressed below, more research is needed to explore why the intention is greater, but these findings hint to the importance of encouraging university faculty researchers to participate in two-way online engagement, especially when sharing their research findings and expertise in the media. This adds to an emerging trend that is beginning to advocate for not only public communication but social media use to be considered in tenure promotion for university faculty researchers (Flaherty, 2016).

### **Practical Implications – Professional Benefits**

Public engagement is rarely a formal requirement for the tenure process and writing for media outlets as an expert seldomly results in financial benefits for university faculty researchers. One of the biggest questions this researcher was hoping to explore when analyzing The Conversation's survey data was what the strongest motivators for university faculty researchers are to engage in public outreach via science media writing.

While the university faculty researchers were not paid and/or necessarily promoted for their science media writing, research question 3 showed that reported professional outcomes do lead to an increased intention to recommend science media writing to a colleague.

The potential options listed on The Conversation's survey questions as "choose all that apply" professional outcomes included Increased citations of scholarly articles (improved H-index, altmetrics or other metrics); Used The Conversation article or metrics as part of grant or other funding opportunity; Been approached for other academic collaborations; Influenced policy by a decision maker; Request(s) to be interviewed by a radio outlet; Request(s) to be interviewed by a TV outlet; Request(s) to be interviewed by a print outlet; Request(s) to write another article in a different outlet; and A book proposal or other book publishing opportunity.

Interestingly, the most frequently chosen professional benefit outcome from this list, as reported in Table 5 above, was Request(s) to be interviewed by a radio outlet, with print opportunities coming in second. Added together, the most answered professional benefit of science media writing reported would be other media opportunities (radio, TV, print and opportunity to write, combined), and would far outweigh the other benefits. This outcome could have been the way in which the survey questions were written and some of the other outcomes may be difficult to definitively attribute as an outcome of the science media writing experience, but these results do give a glimpse at how one form of media outreach – writing for an online publication – may snowball into and/or impact other media outreach opportunities, like being viewed as an expert and invited to participate in a radio interview, which could have positive reputational implications – for universities and for university faculty researchers.

As mentioned above in the research question 3 results, the two highest reported professional benefits in the analysis of open-ended answers by author respondents were Used for

promotion/tenure or other department/institution recognition of public engagement and Increased visibility/networking in field of study. This suggests that universities may be starting to pay more attention to public/media outreach as well as considering science communication more strongly in the tenure process than in years past.

While there are signs that universities and certain academic fields are beginning to value science media writing in this way, as evidenced by the university faculty researchers' comments (reported in qualitative research results above) on tenure promotion and academic visibility above, a few respondents commented on the time commitment and lack of compensation that comes with science media outreach – both hurdles that university public relations professionals and media outlets alike need to overcome in order to work with university faculty researchers on public/media outreach. As more universities, nongovernmental institutions and professional scientific organizations increase emphasis on the importance of science communication in a world that continues to become polarized and politicized (Nisbet and Markowitz, 2016), it is important for universities and their public relations offices to keep in mind the lack of financial benefits and demand on time as well as these professional benefits for university faculty researchers.



## Limitations

While one of the strong benefits of this thesis – the fact that all university faculty researcher respondents had a similar, shared science media writing experience to compare – came from using a survey provided by a media organization, there were also limitations to conducting this research. The researcher had no control over the questions since the research was conducted after the survey was created and put into the field. This limited some of the questions the researcher would have like to have expanded on, including the experience of university faculty researchers of different genders and ages, the amount of respondents who had the opportunity to answer demographic-related questions, the limited list of potential professional benefits options, and the behavior intention of intention to recommend science media writing to a colleague. As noted throughout this thesis, tenure can be an important factor impacting intention. While tenure can be loosely related to age – the average age that a faculty member receives tenure in the United State is 39 (European University Institute, 2018) – it would have been beneficial to include a question about tenure in the survey.

Additionally, some of the survey questions were more “internally-focused” on the processes of the news organization itself, which would have been helpful to the news organization conducting this survey, just not as insightful for this thesis research.

Further, while the research questions in this thesis identified toward factors that increased intention to recommend to a colleague – which supported and advanced past science communications research findings – they weren’t able to fully address the “why” behind some of the findings. Qualitative analysis of two open-ended questions gave a glimpse into some possible “why” reasons, but further research has the potential to more fully address these deeper meanings and causes behind findings.

## **Future Research**

Further research is needed for research question 2. The results showed that female university faculty researchers are more likely to recommend science media writing to a colleague, even though other findings, though not quite significant, indicated that male university faculty researchers might report more professional benefits. These potential outcomes have a similar gender discrepancy in outcomes like past research from Besley, Oh and Nisbet (2013), who found that while female scientists appear to believe media engagement is more important than male scientists, male scientists are more willing and more likely to engage in media. The reasons – the why – for this discrepancy need to be investigated further. Past issues that have been identified as impact aspiring female academic scientists include work-life balance, dual-career marriages and partnerships, fields of study with under-representation of women, and the rise of “non-track” or “off-track” adjunct or part-time faculty positions (National Academy of Sciences, 2014 and Wolf-Wendel and Ward, 2014).

The outcomes in this thesis could have been due to the way the questions were written and the chosen form of analysis (the limitation of professional benefit outcome choices in the questions and less of an emphasis on qualitative research, for example), but more work is needed to investigate the experiences of university faculty researchers of different ages and genders.

Additionally, further research into two-way communication could help uncover why university faculty researchers who participated in two-way online engagement were more likely to recommend science communication writing to a colleague, which could have been any reason ranging from simple enjoyment of the process of engaging with readers to a feeling of impact and making a difference, for example.

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## APPENDIX

This thesis will use the following 16 questions that were part of the 41-question survey of readers, authors and media republishers by The Conversation. The majority of these questions were in the “author” section of the survey, which included responses from 552 scientists who have written for the website.

19. Please tell us about yourself – age
20. Please tell us about yourself – gender
21. Please tell us about yourself - How did you first learn about The Conversation US?
  - a. Web search
  - b. Friend or colleague
  - c. At School
  - d. Social media
  - e. At Work
  - f. Other (please specify) (Open-ended)
22. What is your gross (pre-tax) annual household income?
23. Do you receive our free daily email newsletter?

### Author Questions

24. You selected that you are an author of an article for The Conversation. Do you agree or disagree with the following statement: "I had a positive experience working with The Conversation editor or editors."
25. Was your editor clear on what they wanted in your first draft?
26. Were the edits your editor gave you helpful?
  - a. If so, how? If not, what did you need that could have further assisted you?
27. Have any of the following been outcomes of writing for The Conversation? (Please check all that apply.)
  - a. Increased citations of scholarly articles (improved H-index, altmetrics or other metrics)
  - b. Used The Conversation article or metrics as part of grant or other funding opportunity
  - c. Been approached for other academic collaborations
  - d. Influenced policy by a decision maker
  - e. Other (please specify) (Open-ended)
28. Did publishing your article on The Conversation lead to any further media opportunities such as the following? (Please check all that apply.)
  - a. Request(s) to be interviewed by a radio outlet
  - b. Request(s) to be interviewed by a TV outlet
  - c. Request(s) to be interviewed by a print outlet

- d. Request(s) to write another article in a different outlet
  - e. A book proposal or other book publishing opportunity
  - f. None of these
29. Have you used your author dashboard for any of the following? (Please check all that apply.)
- a. Tracking public engagement of article(s)
  - b. Tracking readers of articles by country
  - c. Tracking republication of article(s)
  - d. Monitoring and responding to comments
  - e. Monitoring and responding to tweets or other social media
  - f. None of these
30. How well do you feel each of the following attributes apply to The Conversation?
- a. Academic / scholarly
  - b. Authoritative
  - c. Easy-to-read
  - d. Engaging
  - e. Intelligent
  - f. Trustworthy
31. How likely are you to recommend to a colleague that they \*write for\* The Conversation? (5-point scale)
32. How can we improve The Conversation? (Open-ended)
33. Anything else we should know about your experience of working with The Conversation? (Open-ended)
34. Overall, how satisfied are you with the science coverage provided by The Conversation? (5-point scale)