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# Can Anyone Hear Us? An Exploration of Echo Chambers at a Land-Grant University

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# Can Anyone Hear Us? An Exploration of Echo Chambers at a Land-Grant University

**Abstract**

Faculty at land-grant universities are expected to engage in some form of Extension, or science communication, as part of the land-grant mission. However, critics have claimed these institutions are out of touch with their stakeholders' needs and faculty mainly communicate with others in academia. This engagement with a homogenous group reflects the concepts of echo chambers, where people are only exposed to information that aligns with their beliefs and current knowledge and discredit opposing information. An explanatory mixed-methods design was used to understand land-grant faculty's engagement in echo chambers. A survey was distributed to a census of tenure-track faculty in the University of Florida's Institute of Food and Agricultural Sciences to understand respondents' engagement in echo chambers. Follow-up interviews were conducted with 13 of the survey respondents to further explore their audiences and channels used in science communication to understand their engagement in echo chambers. Survey results indicated faculty did not necessarily participate in echo chambers, but they also did not contribute to an open communication network. However, the interviews found participants were interested in reaching new audiences yet struggled to communicate with stakeholders. The participants also reported wanting to find alternative channels to peer reviewed journals to help disseminate their work. The findings from this study indicated faculty contributed to a type of echo chamber, but rather than viewing their stakeholders' opinions as false, they simply did not hear the opinions. Agricultural communicators should work with land-grant faculty administrators to identify appropriate audiences and channels for science communication.

**Keywords**

Science Communication, Echo Chambers, Land-grant universities



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## Introduction

In recent years, the American public has indicated increased levels of distrust in higher education (Fingerhut, 2017) and demonstrated large variation in knowledge when it came to issues in science (National Academies of Sciences [NAS], 2016). This sense of distrust and waning levels of knowledge could make it difficult for members of the public to engage in high forms of science literacy, where they are able to make sense of complex, scientific topics (Takahashi & Tandoc, 2016) and engage in policy decisions related to the matters (Miller, 2010). Science communication, which has been defined as communication directly from researchers about science to non-science audiences, can help to address these issues in science literacy (Bennett & Iyengar, 2008; Pearson, 2001). Despite the increased skepticism in the value of higher education (Fingerhut, 2017), university scientists have remained the most trusted sources to communicate science to the public (Brewer & Ley, 2013).

Unfortunately, scientists have also been accused of being out of touch with the needs of their stakeholders due to a lack of engagement between universities and the public (Besley & Tanner, 2011; Weerts & Sandmann, 2010). Part of this issue may stem from tenure-track faculty's perception that the strongest influences on tenure and promotion have been securing grants (Slaughter & Rhoades, 2004) and publishing in top-tier, academic journals – meeting the needs of stakeholders has been their lowest priority (Barham, Foltz, Agnes, & van Rijn 2017). However, faculty will need to communicate with those outside of the academic community to be truly effective in their communication efforts (Heleta, 2017). This is particularly true for tenure-track faculty at land-grant institutions who are expected to engage in some form of teaching, research, and Extension regardless of their formal appointments (National Institute of Food and Agriculture [NIFA], n.d.). The latter of those three, Extension, often refers to public engagement, or science communication, from experts in the field.

Successful engagement in science communication has become increasingly complicated in recent years due to changes in the media landscape, particularly the advent of the internet (National Science Board [NSB], 2014). People can now actively search for information they are interested in from online news sources, while also receiving information from popular opinion bloggers and their peers on social media (Barthel, Shearer, Gottfried, & Mitchell, 2015; Brandtzaeg, Heim, & Karahasanovic, 2011). Because consumers have the ability to choose their news and their sources, they typically select information that matches their current values, attitudes, and beliefs, and ignore other sources that challenge them (Prior, 2007). Another issue is science does not always deliver newsworthy topics, and the news media gives more time to stories on crime and politics than science and technology (Baker, Williams, Lybbert, & Johnson, 2012). Even though news coverage has been found to increase knowledge of some science topics, like climate change (Kahlor & Rosenthal, 2009; O'Neill & Nicholson-Cole, 2009), some journalists do not believe science stories will increase readership due to the public's low levels of science literacy (Baker et al., 2012).

Another challenge with science communication is more and more Americans are receiving their science information from non-traditional sources like blogs, which are not necessarily written by scientists or always factual. Consumers receiving science information from these online sources could potentially lead to science literacy problems. To further compound the problem, the majority of scientists do not use social media to talk about their science (Peters, 2013) or even feel confident in using social media to promote their area of research (NSB, 2016; Ruth, Telg, Rumble, Lundy, & Lindsey, 2017).

Research conducted at land-grant universities is intended to meet the needs of the community (Higher Learning Commission, 2010), but this can be difficult to accomplish if faculty are only communicating with one another. In addition to producing research that is not relevant to the institutions' stakeholders, lack of communication across diverse audiences could lead to varying levels of attitudes and knowledge related to science. Research has found differences in attitude and acceptance in agricultural and natural resource topics related to gender, age, income, and race/ethnicity (Antonopoulou, Papadas, & Targoutzidis, 2009; Clark, Stewart, Panzone, Kyriazakis, & Frewer, 2016; Makki, Stewart, Panuwatwanich, & Beal, 2013; McKendree, Croney, & Widmar, 2014; Ruth, Gay, Rumble, & Rodriguez, 2016). Women have been found to be more interested in topics related to health, medicine, and food safety, but men have been more interested in science and technology topics (Kennedy & Funk, 2015). Additionally, men have been found to have higher levels of science literacy compared to women (Funk & Goo, 2015). Younger adults have also expressed greater interest in science topics compared to older generations (Kennedy & Funk, 2015). To address these discrepancies in knowledge and attitude and fulfill the land-grant mission, faculty will have to communicate with stakeholders outside of their own academic community. Therefore, the purpose of this study was to explore land-grant faculty's engagement in echo chambers when communicating about science. This research can provide guidance for how agricultural communicators can help land-grant faculty engage in science communication in the future.

## Conceptual Framework

This study was guided by the concept of echo chambers, which is a theory that emerged in recent years to explain how information is shared on the internet and social media (Jasny, Wagle, & Fisher, 2015; Prior, 2007). For the purpose of this research, echo chambers have been defined as participation in homogenous networks that limit exposure to alternative views and beliefs (Colleoni, Rozza, & Arvidson, 2014). The phenomenon can be broken down into two distinct parts – the echo and the chamber. An echo is defined as the message that repeats and reinforces the views of participants in the conversations. The chambers are the mechanism through which the echo travels and consists of a speaker, a receiver, and a mediating actor (Jasny et al., 2015).

The development of these echo chambers reinforces the perspectives and opinions that a person has already established and limits exposure to a diversity of opinions (Colleoni et al., 2014). These homogenous networks created in echo chambers can be problematic because people are more likely to search for information across a variety of topics if their social group is more heterogeneous in nature (Scheufele, Hardy, Brossard, Waismel-Manor, & Nisbet, 2006). Senator John McCain discussed echo chambers in a 2017 speech where he said, "We are asleep in our echo chambers, where our views are always affirmed, and information that contradicts them is always fake," (Ohl & Pacella, 2018, para. 17).

The most concerning effect of echo chambers has been the increasing gaps in knowledge among the public because they are only engaging in information they trust that aligns with their views (Bennett & Iyengar, 2008) and they no longer see the validity in opposing views (Huckfeldt, Mendez, & Osborn, 2004; Price, Cappella, & Nir, 2002). Discussion of echo chambers have remained mostly within the context of political affiliation; however, this phenomenon has also been found to impact perceptions of issues in science, like climate change (Elsasser & Dunlap, 2012). Conservative news has reportedly covered climate change in a dismissive manner that was skeptical of the science, which Elsasser and Dunlap (2012) concluded amplified climate change deniers' message.

While limited peer-review research has been conducted on echo chambers amongst university faculty, an echo chamber still likely exists. Heleta (2017) suggested faculty's research has mostly been published in an echo chamber, or homogenous network, of academic journals only read by peers. As a result, the public has remained largely unaware of the research conducted at universities. However, faculty not engaging the public does not necessarily mean they no longer view the public's views as credible, which is an important characteristic of echo chambers. Faculty may actually be engaging in what has been referred to as an epistemic bubble. Rather than opposing voices being discredited or cited as fake, they are simply not included in the conversation (Nguyen, 2018). Nguyen (2018) proposed both echo chambers and epistemic bubbles can lead to confirmation bias and gaps in knowledge, but the solution to opening these two networks greatly differ. Epistemic bubbles can easily open with the introduction of new sources of information or new voices in the conversation. Echo chambers are stronger and reflect individual's beliefs. To overcome an echo chamber, members have to restore trust and faith in outside voices (Nguyen, 2018).

To help faculty fulfill the land-grant mission (NIFA, n.d.), there is a need to further explore the development of echo chambers in academia (Jasny et al., 2015). For the purpose of this paper, the faculty are assumed to be the speaker in the chamber, but their receiver (audience) and mediating actor (communication channel) will determine the degree to which faculty engage in echo chambers.

## Purpose and Objectives

The purpose of this study was to explore University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS), tenure-track faculty's engagement in echo chambers when communicating science. The following research objectives guided the study:

1. Describe UF/IFAS, tenure-track faculty's engagement in echo chambers.
2. Explore UF/IFAS, tenure-track faculty's audiences when communicating science.
3. Explore UF/IFAS, tenure-track faculty's communication channels when communicating science.

## Methods

A mixed-methods approach was used to fulfill the purpose of this study. Specifically, this study used an explanatory sequential design. The purpose of the explanatory sequential design is to use qualitative methods to explain quantitative findings (Creswell & Plano Clark, 2011). The data are collected in two separate phases: phase one is quantitative and phase two is qualitative. While the qualitative phase was used to explore and explain significant findings from the quantitative phase, this study also used the quantitative phase to identify groups for purposive sampling in the qualitative phase (Creswell, Plano Clark, Gutmann, & Hanson, 2003; Morgan, 1988; Teddlie & Tashakkori, 1998). For this study, respondents were purposively sampled for interviews to represent high, moderate, and low science communicators. The purposive sampling procedures have been described in greater detail later in this paper.

### Context

The population of interest were tenure-track faculty in UF/IFAS. UF is a land-grant university, and UF/IFAS is home to 51,000 students and 569 tenure-track faculty in 33 departments (UF/IFAS, 2013). In 2016, UF/IFAS received $140 million in sponsored research projects and delivered a $20 return in agricultural productivity for every $1 invested in research (UF/IFAS, 2017). Despite the university's contribution to the state, Florida's governor cut $6 million from UF/IFAS' budget for the 2017/2018 fiscal year, which cut reoccurring dollars that supported 35 faculty members (Rusnak, 2017). Additionally, a faculty member in UF/IFAS had experienced severe public backlash from the public due to their science communication efforts in 2015 (Kroll, 2015). Even though UF has been identified as one of the top ten public universities in America (Orlando, 2017), budget cuts and public scrutiny may have influenced science communication efforts and engagement in echo chambers.

**Phase 1: Quantitative**

Quantitative data were collected in the first phase of the study. An online survey with 45 questions was distributed to a census of tenure-track faculty in UF/IFAS ($N$ = 569). At the beginning of the survey, respondents were told "for the purpose of this study, science communication is when researchers engage in meaningful communication with the public about their science." The survey asked a variety of questions related to faculty's engagement in science communication, but this study has examined three of those questions. The first question asked about faculty's engagement in echo chambers. *Engagement in echo chambers* was measured through seven, five-point bipolar semantic differential statements. These statements were researcher developed and created to represent faculty's contribution to an echo-chamber, or a closed communication system where they only discuss their research with those who have values similar to their own. The items were as follows:

- In general, how often do members of the public ask you about science?
  a) Never/Very Often.
- How would you describe the people who ask you questions about science?
  a) Different from me/Similar to me.
- Think about the people who you talk to about science. How would you describe these people?
  a) They have a variety of attitudes and beliefs that differ from my own/They share similar attitudes and beliefs to me.
- In general, how much information do you provide when you are asked about your field of science?
  a) Very little information/A great deal of information.
- How often do you engage the public in discussions about your field of science?
  a) Never/Very often
- When delivering presentations about your field of science, does your audience typically:
  a) Have attitudes and values that differ from me/Share attitudes and values similar to me.
- Consider the groups of people you spend time with socially. How would you describe them?
  a) People who have values and attitudes that differ from mine/ People who have values and attitudes similar to mine.

These items were coded so that if the respondent was contributing to an open system, they were assigned a one, and if they contributed to a closed system, they were assigned a five. The original reliability for the scale was 0.69. Removal of the item, "In general, how much information do you provide when you are asked about your field of science?" increased the Cronbach's $\alpha$ to 0.70. The remaining items were averaged to create the index. To interpret the echo chamber measurement, the following real limits (Sheskin, 2004) were established: 1.00 – 1.49 = strong contribution to an open system, 1.50 – 2.49 = contribution to an open system, 2.50 – 3.49 = contribution to neither a closed or open system, 3.50 – 4.49 = contribution to a closed system, 4.50 – 5.00 = strong contribution to a closed system.


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Quantitative measures were also used for purposive sampling in the qualitative phase of the study. Level of *effective science communication* was determined by transforming a *frequency of science communication* variable and a *quality of science communication* variable. To measure *frequency*, respondents were asked how often they had participated in 15 different types of public engagement in the past 12 months (*never* = 0, *1-2 times* = 1, *3-4 times* = 2, *5-6 times* = 3, *7-8 times* = 4, *9-10 times* = 5, and *11+ times* = 6). The responses were transformed into a count variable that could range from 0 to 105. The public engagement examples given to respondents included delivering a formal presentation, using social media, hosting a webinar, and speaking at a science café to name a few.

*Quality of science communication* was measured with a 9-item, 5-point Likert-type scale (Cronbach's $\alpha = 0.77$) with the following labels: 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree not disagree*, 4 = *agree*, and 5 = *strongly agree*. The statements were adapted from the American Association for the Advancement of Science (AAAS, 2017) recommendations for science communication and included statements like, "I removed scientific jargon from my presentation," "I considered my audience's demographic characteristics (e.g. age, gender, SES)," and "I provided interactive opportunities with my audience." Respondents were also given the option to select "Not Applicable," and these responses were omitted from analysis.

The variables for *frequency of science communication* and *quality of science communication* were multiplied together to create the variable for *effective science communication*, and the scores could potentially range from 0 to 525. The range for the survey sample was 0 to 181.56, and the mean was 55.72 ($SD = 38.16$, $n = 162$). Groups for low, moderate, and high science communicators were categorized based on the mean response of the sample. Low science communicators had scores below one standard deviation of the mean ($M < 17.56$, $n = 26$) and high science communicators were above one standard deviation of the mean ($M > 93.88$, $n = 32$). Moderate science communicators were categorized as those having a mean between 17.56 and 93.88 ($n = 104$).

To help increase the validity and reliability of the study, the survey instrument was distributed in a pilot study to a peer institution (Ary, Jacobs, & Sorensen, 2010). In the pilot study, no issues had been identified related to quality of science communication or quantity of science communication measurements; however, the initial reliability of the echo chamber construct was 0.41. Items in the initial construct had asked respondents not only about their communication with people, but how they received information. Removal of the items asking about how respondents received or searched for information increased the reliability of the scale. Additional items related to how respondents communicate to the public were added to the scale, as described previously. Additionally, a panel of experts with experience in survey methodology, science communication, and bench science research reviewed the survey prior to distribution.

Data collection procedures followed Dillman's tailored design (Dillman, Smith, & Christian, 2014). Personalized emails with individual links to the survey were sent to a census of UF/IFAS, tenure-track faculty inviting them to participate in the study. Two follow-up emails and a final notice were also sent to potential respondents who had not completed the survey. The survey closed after being open for 17 days, and there were 180 ($n = 180$, 31.6% response rate) complete and useable responses.

The demographics for the survey respondents can be found in Tables 1 and 2. The majority of the sample were male, white, and had accrued tenure. On average, the respondents were approximately 50 years old ($M = 49.84$, $SD = 11.65$). Information was also collected regarding the respondents' academic appointment. Respondents had the highest average appointment in research

(*M* = 47.83%, *SD* = 26.93), followed by teaching (*M* = 24.97%, *SD* = 24.41) and Extension (*M* = 24.13%, *SD* = 28.09). The survey also asked the respondents about their home department. These answers were recategorized to protect the identities of the subjects. The disciplines were categorized as social science (Nisbet, 2018), basic science (Ledoux, 2002), and applied science (West, 2018). The majority of respondents were in an applied science discipline (58.3%, *n* = 104). Social science (19.7%, *n* = 35) and basic science disciplines (19.2%, *n* = 34) made up the remainder of the sample. Demographic information for low, moderate, and high communicators have also been provided in Tables 1 and 2.


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Table 1
*Description of Survey Respondents (Categorical Variables)*

| | *Total Respondents (n = 180)* | | *Low Communicators (n =26)* | | *Moderate Communicators (n = 104)* | | *High Communicators (n = 32)* | |
|---|---|---|---|---|---|---|---|---|
| | *f* | *%* | *f* | *%* | *f* | *%* | *f* | *%* |
| Sex (*n* = 179) | | | | | | | | |
| Male | 132 | 73.7 | 19 | 73.1 | 75 | 72.8 | 22 | 68.8 |
| Female | 47 | 26.3 | 7 | 26.9 | 28 | 27.2 | 10 | 31.3 |
| Rank (*n* = 179) | | | | | | | | |
| Assistant Professor | 57 | 31.8 | 8 | 30.8 | 38 | 36.5 | 4 | 12.9 |
| Associate Professor | 39 | 21.8 | 4 | 15.4 | 22 | 21.2 | 12 | 38.7 |
| Professor | 83 | 46.4 | 14 | 53.8 | 44 | 42.3 | 15 | 48.4 |
| Administrative Role | | | | | | | | |
| Dean/Associate Dean | 6 | 3.3 | 1 | 3.8 | 4 | 3.8 | 0 | 0.0 |
| Department Chair | 5 | 2.8 | 0 | 0.0 | 3 | 2.9 | 1 | 3.1 |
| Associate Department Chair | 4 | 2.2 | 1 | 3.8 | 2 | 1.9 | 1 | 3.1 |
| University Center Director/Associate Director | 13 | 7.2 | 0 | 7 | 7 | 6.7 | 5 | 15.6 |
| Other | 18 | 10.0 | 1 | 3.8 | 9 | 8.7 | 4 | 12.5 |
| Race/Ethnicity | | | | | | | | |
| White | 149 | 82.8 | 21 | 80.8 | 85 | 81.7 | 31 | 96.9 |
| Hispanic, Latino, or Spanish Origin | 15 | 8.3 | 2 | 7.7 | 13 | 12.5 | 0 | 0.0 |
| Asian | 12 | 6.7 | 2 | 7.7 | 7 | 6.7 | 1 | 3.1 |
| Other | 4 | 2.2 | 0 | 0.0 | 1 | 1.0 | 0 | 0.0 |
| Black or African American | 3 | 1.7 | 0 | 0.0 | 2 | 1.9 | 0 | 0.0 |
| American Indian or Alaska Native | 2 | 1.1 | 0 | 0.0 | 2 | 1.9 | 0 | 0.0 |
| Middle Eastern or North African | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Native Hawaiian of Pacific Islander | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Discipline | | | | | | | | |
| Applied Science | 104 | 58.3 | 11 | 42.3 | 71 | 68.3 | 17 | 53.1 |
| Social Science | 35 | 19.7 | 5 | 19.2 | 18 | 17.3 | 8 | 25.0 |
| Basic Science | 34 | 19.2 | 10 | 38.5 | 15 | 14.4 | 7 | 21.9 |

*Note*. Some respondents elected not to answer all demographic questions.

Table 2
*Description of Survey Respondents (Continuous Variables)*

| | *Total Respondents (n = 180) M (SD)* | *Low Communicators (n =26) M (SD)* | *Moderate Communicators (n = 104) M (SD)* | *High Communicators (n = 32) M (SD)* |
|---|---|---|---|---|
| Age (*n* =175) | 49.84 (11.65) | 50.62 (11.80) | 49.06 (11.56) | 51.35 (9.20) |
| % Research Appointment | 47.83 (26.93) | 54.04 (26.61) | 50.63 (24.40) | 32.65 (27.65) |
| % Teaching Appointment | 24.97 (24.41) | 34.62 (23.32) | 24.23 (24.05) | 21.25 (24.82) |
| % Extension Appointment | 24.13 (28.09) | 6.35 (17.17) | 23.15 (27.65) | 44.53 (23.97) |

*Note*. Some respondents elected not to answer all demographic questions.

Non-response error was also addressed in the study because the response rate fell below 80% (Gall, Borg, & Gall, 1996). Demographics of non-respondents were compared to respondents to determine if there was a threat of non-response error skewing the results (Koch & Blohm, 2016, Lewis, Hardy, & Snaith, 2013; Linder, Murphy, & Briers, 2001). Demographic characteristics that were publicly available for non-respondents (discipline, rank, and gender) were compared to respondents' demographics. A chi-square analysis revealed there were no associations for rank ($p = .32$) or gender ($p = .61$) between respondents and non-respondents; however, there was an association between respondents and discipline ($p = .01$). A smaller portion of non-respondents (19.4%) were social scientists compared to respondents (10.5%). Additionally, there was an association between respondents/non-respondents and administrative role ($p = .05$). There was a greater proportion of respondents with administrative roles compared to non-respondents. This difference could have caused bias in the results, so an additional measure of non-response error was used in the study. Late respondents were compared to early respondents on key variables of interest (Lin & Schafer, 1995; Lindner et al., 2001). Late responders were considered the last 50% of respondents and served as a proxy for non-responders. A series of independent t-tests found no statistically significant differences between early and late respondents for key variables. Non-response error was assumed to be limited. All data were analyzed in SPSS. Descriptive statistics were used to fulfill objective one for the study to describe respondents' engagement in echo chambers.

**Phase 2: Qualitative**

Qualitative data were collected to fulfill objectives two and three of the study. Hour-long, semi-structured interviews were conducted with 13 tenure-track faculty ($n = 13$) in UF/IFAS in February 2018. This type of data collection is appropriate to use when not much is known about the phenomena in question (Creswell, 2013), like echo chambers. While the findings from the study are not generalizable, they do provide valuable insight into how faculty are engaging in echo chambers (Robinson, 1999).

The participants of the qualitative portion of the study, were purposively sampled to match the demographic characteristics of the low, moderate, and high science communicators determined in the quantitative phase (Tables 1 and 2). These participants were selected to help make the qualitative findings more transferable to the population. Thirty-one potential participants were invited for an interview, and 13 from 10 different departments/units agreed to participate (41.9% participation rate). Five of the participants were high communicators and five were moderate communicators. Only three low communicators agreed to participate in the study despite multiple requests to 14 low communicators. Interviews were conducted until saturation was met and themes were consistently reoccurring across interviews (Strauss & Corbin, 1998). The majority of the interview participants were tenured, in applied science fields, male, and their highest appointment was in research. The demographics of the interview participants in the three communication groups can be found in Table 3.

Table 3
*Description of Interview Participants*

| | High Communicators (*n* = 5) | Moderate Communicators (*n* = 5) | Low Communicators (*n* = 3) |
|---|---|---|---|
| Rank | | | |
| Assistant Professor | 2 | 1 | 2 |
| Associate Professor | 1 | 0 | 1 |
| Professor | 2 | 4 | 0 |
| Administrative Role[a] | 2 | 3 | 0 |
| Discipline | | | |
| Social Science | 2 | 2 | 1 |
| Basic Science | 1 | 0 | 1 |
| Applied Science | 2 | 3 | 1 |
| Average Appointment | | | |
| % Teaching | 30 | 33 | 40 |
| % Research | 35 | 41 | 60 |
| % Extension | 25 | 32 | 0 |
| Gender | | | |
| Female | 3 | 1 | 2 |
| Male | 3 | 4 | 1 |

[a] Participants with administrative role could be any rank.

A detailed description of each high science communicator along with their anonymous identification number can be found in Table 4. Moderate science communicators are presented in Table 5 and low science communicators in Table 6.

Table 4
*Description of High Communication Participant Characteristics*

| | Participant ID | | | | |
|---|---|---|---|---|---|
| | #5 | #17 | #88 | #93 | #158 |
| Rank | Assistant Professor | Associate Professor | Professor | Professor | Assistant Professor |
| Administrative Role[a] | No | No | Yes | Yes | No |
| Science Discipline | Basic | Applied | Applied | Social | Social |
| Appointment | | | | | |
| % Teaching | 30 | 60 | 0 | 60 | 0 |
| % Research | 70 | 20 | 30 | 20 | 35 |
| % Extension | 0 | 20 | 20 | 20 | 65 |
| Gender | Female | Female | Male | Male | Female |
| Race | White | White | White | White | White |
| Age | 47 | 53 | 45 | 43 | 44 |

Table 5
*Description of Moderate Communication Participant Characteristics*

| | Participant ID | | | | |
|---|---|---|---|---|---|
| | #9 | #29 | #143 | #154 | #188 |
| Rank | Professor | Professor | Assistant Professor | Professor | Professor |
| Administrative Role[a] | Yes | No | No | Yes | Yes |
| Science Discipline | Social | Applied | Applied | Social | Applied |
| Appointment | | | | | |
| % Teaching | 40 | 25 | 0 | 70 | 30 |
| % Research | 40 | 75 | 70 | 0 | 20 |
| % Extension | 20 | 0 | 30 | 30 | 50 |
| Gender | Male | Male | Male | Male | Female |
| Race | White | White | Asian | White | White |
| Age | 62 | 51 | 41 | 57 | 60 |

Table 6
*Description of Low Communication Participant Characteristics*

| | Participant ID | | |
|---|---|---|---|
| | #37 | #133 | #155 |
| Rank | Assistant Professor | Assistant Professor | Associate Professor |
| Administrative Role[a] | No | No | No |
| Science Discipline | Basic | Social | Applied |
| Appointment | | | |
| % Teaching | 40 | 40 | 40 |
| % Research | 60 | 60 | 60 |
| % Extension | 0 | 0 | 0 |
| Gender | Female | Female | Male |
| Race | White | Asian | White |


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| | | | |
|---|---|---|---|
| Age | 35 | 40 | 46 |

The majority of the interviews were conducted in person, but two interviews were conducted through a video conference call because the faculty worked at an experiment station away from main campus. All interviews were recorded, and an external company transcribed them. Analysis for this study used a priori coding to examine themes related to echo chambers (Kuzel, 1999). Specifically, the primary researcher looked for themes related to the audience and communication channel the participants used for science communication to align with Jasny et al.'s (2015) description of "chambers". The computer program MAXQDA 2018 (VERBI Software, 2017) was used to aid the researcher in coding the interview transcripts and memos were kept to record coding decisions.

Validity and reliability were accounted for by the use of an audit trail, peer debriefing, member checking, triangulation, clarifying researcher bias, and including thick and rich descriptions (Creswell, 2013; Thomas & Magilvy, 2011). Credibility was increased by giving participants the opportunity to review the researchers' summary of key points from the interview as well as their interview transcripts (Lincoln & Guba, 1985; Stake, 1995). Additionally, the use of qualitative interviews helped to corroborate the study's quantitative phase through triangulation (Creswell, 2013). Confirmability, or how data supported the findings, was accounted for through peer debriefing. A researcher familiar with the study challenged and questioned the primary researchers' conclusions to ensure findings were not overstated or biased (Lincoln & Guba, 1985). Confirmability was also kept through detailed audit trails that recorded coding decisions and definitions (Thomas & Magilvy, 2011). The context of the study along with thick and rich description of the participants and their responses have been included to assist with the transferability of the study.

Merriam (1988) recommended clarifying researcher bias as an additional way to establish credibility. The primary investigator for this research has three degrees from UF and an interest in science communication, which may have influenced the interpretation of the findings. To aid in the transferability of the findings, context of the institution and participants have also been provided (Merriam, 1988).

## Findings

### Describe UF/IFAS, tenure-track faculty's engagement in echo chambers

Phase one of the study collected quantitative data about respondents' engagement in echo chambers. Survey respondents reported spending time with people who had attitudes and values similar to their own ($M$ = 3.77, $SD$ = 0.86). However, their scores were neutral for the remaining items measuring echo chambers (Table 7). The mean for the echo chamber index was 3.03 ($SD$ = 0.61), which indicated that respondents contributed to neither a closed nor open system when engaging with the public.

Table 7
*Respondents' Engagement in Echo Chambers*

| | *Mean* | *SD* |
|---|---|---|
| Consider the groups of people you spend time with socially. How would you describe them? | 3.77 | 0.86 |

| | | |
|---|---|---|
| *People who have values and attitudes that differ from mine/ People who have values and attitudes similar to mine.* | | |
| When delivering presentations about your field of science, does your audience typically: | 3.27 | 0.82 |
| *Have attitudes and values that differ from me/Share attitudes and values similar to me.* | | |
| How often do you engage the public in discussions about your field of science? | 2.92 | 1.03 |
| *Never/Very Often*[a] | | |
| How would you describe the people who ask you questions about science? | 2.86 | 0.98 |
| *Different from me/Similar to me.* | | |
| Think about the people who you talk to about science. How would you describe these people? | 2.78 | 1.01 |
| *They have a variety of attitudes and beliefs that differ from my own/They share similar attitudes and beliefs to me.* | | |
| In general, how often do members of the public ask you about science? | 2.60 | 1.11 |
| *Never/Very Often.*[a] | | |

*Note*. 1.00 – 1.49 = strong contribution to an open system, 1.50 – 2.49 = contribution to an open system, 2.50 – 3.49 = contribution to neither a closed or open system, 3.50 – 4.49 = contribution to a closed system, 4.50 – 5.00 = strong contribution to a closed system.
[a] Indicates reverse coding.

**Explore UF/IFAS, tenure-track faculty's audiences when communicating science**

Phase two of the study further explored participants' engagement in echo chambers through in-depth interviews. During the interviews, some participants expressed the need for faculty to expand their audiences beyond those involved in academia. "I think the days of just sitting in the ivory tower and doing good science for the sake of good science are over," explained Participant 154 (moderate communicator). These participants believed it was necessary for academics to also engage with the public to stay in touch with the needs of their stakeholders. Participant 158 (high communicator) believed communicating with the public was essential to understanding problems in society:

> I learn so much from being out there and talking to some of the [practitioners] that do this day in and day out, that don't sit in the ivory tower like we do and sit here and we'll research it to death, but we don't know what the actual [problem is].

Participant 17 (high communicator) agreed "being in touch with what's going on out there" was important. However, as the interviews progressed, it became evident the participants were communicating with people similar to themselves. "Usually, they're all really well-trained scientists," explained Participant 155 (low communicator). "I mainly interact with the agency scientists, sometimes the upper administration in agencies. I find them all to be incredibly reasonable individuals."

Similarly, another low communicator (Participant 133) was discussing her science communication efforts of presenting research at an outreach event but reported mostly talking to people who approached her to ask "questions or they introduce themselves because they're doing something similar [in research]." A high communicator who researches a natural resource commonly used by all ages, genders, and races described his stakeholders as, "pretty similar" to him. "I'd say demographically they'd be older, but White males, yeah. Males for sure, with some females, but maybe a little bit older." (Participant 88 – high communicator).

High communicators also demonstrated some participation in echo chambers when it came to their social media use specifically. Participant 88 (high communicator) explained the success of his Twitter account, but when asked who his followers were, he replied most of his "followers were UF/IFAS employees." Participant 5, another high communicator with a Twitter account, had a similar social media audience.

> I guess Twitter technically is the public, right. I follow scientists, scientists follow me. It's more of a public science community rather than a non-scientific community. The non-science community I probably, unfortunately, talk to the least just because of the type of events I attend and get invited to. It's usually people with a scientific interest that I end up communicating with.

The emergence of echo chambers through the communication audience was evident despite some participants' intent and interest to communicate with the public. Some participants may have realized they only talked to other like-minded individuals, but they did not indicate an interest in interacting with other members of the public. Other participants believed they were engaging the public, but further probing revealed their audiences consisted of academics, scientists, and industry professionals. These audiences indicated a closed communication network, or echo chamber.

**Explore UF/IFAS, tenure-track faculty's communication channels when communicating science**

Aside from who the participants were communicating to about science, how they were communicating was also explored in relation to echo chambers. Participants indicated they realized their communication channels for research contributed to echo chambers and expressed an interest in utilizing different channels to break the echo effect. Many participants brought up the idea that "no one is going to read [my research] in a journal," (Participant 155 – low communicator). "I think we need to really get away from this model of publishing these papers and have that be our sole focus. Finding other ways to communicate about what we do is, I think, really important," reasoned Participant 37 (low communicator).

Others had also noted the need to shift away from this traditional mode of publishing research. Participant 93 (high communicator) explained why he decided to start engaging more in science communication and develop a podcast.

> Well, our research goes and hides in a journal that nobody can find. We've had taskforces. We've had grant teams. We've had all these committees to do it, and I just decided I was at a point in my career that I was just going to do something and ask for permission later.

He had similar feelings toward working with reporters;

> I think [reporters] are important—it's important for us to engage with the media in that way, because, right or wrong, every time you say, "No, I'm not going to talk to you," then you create a vacuum. That vacuum is never filled with a positive story. They're going to find some sort of negativity to fill that vacuum. (Participant 93 – high).

Another high communicator discussed how she emphasized sharing science through different popular media channels with her students:

> We had that discussion in my class before this interview. [Students] were pulling up websites on these people and it's these people who have no science base that have the social media followers and all that type of thing. In order to combat [misinformation] at that level, [scientists] will have to not be just communicating proper science one-to-one, but they have to get on Morning America or whatever it is. They have to be there. They have to be doing the major media stuff or else they can't combat what's out there. It's up to them. (Participant 17 – high communicator)

Overall, participants appeared to not always recognize their contribution to echo chambers through who they communicate to, but they have identified how the communication channel for presenting research is related to this closed system. Additionally, participants expressed an interest in finding ways to overcome the echo chamber effect and communicate to the public through appropriate channels.

## Discussion & Implications

This research used a mixed-methods approach to understand tenure-track, land-grant faculty's engagement in science communication. Overall, the findings from this study support the use of echo chambers as a framework for understanding faculty's engagement in science communication. The quantitative findings indicated UF/IFAS faculty communicated in neither a closed nor open system. The only item in the echo chamber scale that indicated faculty contributed to a closed system discussed the types of people the respondents spent time with socially. This finding could prove to be troublesome. Faculty are expected to meet the needs of their constituents through research (Higher Learning Commission, 2010), a goal that would be difficult to meet without engaging with people possessing a variety of needs in an open-communication system. Limiting exposure to different values and beliefs could cause faculty to not acknowledge the legitimacy in others' views toward science (Huckfeldt et al., 2004; Price et al., 2002). Additionally, only communicating to one specific type of group could further polarize attitudes toward agricultural and basic science topics across demographics groups (Antonopoulou et al., 2016; Makki et al., 2013; McKendree et al., 2014; Ruth et al., 2016). However, the echo chamber questions did not ask about who faculty spent time with professionally, and faculty may be exposed to different opinions and values through those connections. Overall, respondents indicated they were contributing to neither a closed nor open system for the remainder of the questions.

The qualitative phase of this study further explored echo chambers in terms of audience and communication channel. High communicators described how academia needed to get out of their “ivory towers” and communicate with the general public. Stakeholders have expressed frustration when working with universities that appear unfamiliar with the needs of the community (Weerts & Sandmann, 2010); a frustration that is now emerging across faculty groups as well. The concept of these ivory towers may reflect the institution’s emphasis on securing grants and journal publications (Barham at el., 2017; Slaughter & Rhoades, 2004) and how faculty have reported meeting the needs of stakeholders was their lowest perceived priority for tenure (Barham et al., 2017). The participants’ inclination to engage more with the public indicates a possible shift in science communication for the future.

While most of the participants indicated they wanted to engage more with the public, they appeared to mostly communicate with those in academia or researchers with graduate degrees in similar fields. Contrary to prior conclusions (Peters, 2013), participants’ use of social media somewhat demonstrated their understanding of where members of the public looked for science information. However, even high communicators who believed they were utilizing social media to communicate to the public admitted their audience was actually other scientists. This use of Twitter reflected the participants’ lack of understanding for best practices when using social media to reach audiences beyond those in academia (Ruth et al., 2017). Besley and Tanner (2011) suggested that many scientists were out of touch with how the public viewed science, which may be the result of a lack of communication between scientists and members of the public. Scientists exclusively communicating to those in academia or other researchers could continue to widen the knowledge gap between people with varying levels of education (NSB, 2016). Additionally, some of the male participants indicated mostly communicating to stakeholders who were like them demographically, which would contribute to the already identified issue of men possessing higher levels of science literacy (Funk & Goo, 2015)

Participants also discussed a need to move away from the traditional model of communicating research in academia via research journals, which aligned with Heleta’s (2017) conclusions about faculty’s communication outlets for their research. Participants believed engaging in more popular forms of communication, like podcasts, televisions interviews, and newspaper interviews were necessary to provide the public with factual information about science. Faculty may continue to struggle to communicate through these popular media channels though if one of their strongest influences for tenure and promotion is publishing in top tier journals (Barham et al., 2017).

Heleta’s (2017) conclusion that university faculty communicate in homogenous networks, or echo chambers, which leaves the public unaware about the research conducted at the institution, was somewhat supported by this research. The quantitative findings indicated the respondents contributed to neither a closed nor open communication system; however, the qualitative findings indicated participants valued engaging the public even though they found it difficult to communicate to their target audiences. The theoretical implications from this study imply that even if consumers attempt to seek science information from land-grant faculty, they may not necessarily find it presented in a way they would understand. Additionally, the quantitative measurement asked about how respondents shared information and not where they themselves received information. The findings from this study contributed to the development of a measurement for echo chambers. However, the construct only focused on how faculty contribute to an echo chamber, not their own engagement in echo chambers related to how they receive information. Additionally, faculty engagement in echo chambers appeared to be fueled less by beliefs and values and more by not using appropriate strategies to ensure their intended audience received their message. This finding indicated faculty are likely engaging in epistemic bubbles opposed to true echo chambers (Nguyen, 2018). Luckily, these epistemic bubbles can easily be overcome by the introduction of new voices and transforming the homogenous network to a heterogenous network (Nguyen, 2018). Theoretical discussion of echo chambers should take care to differentiate between true echo chambers and epistemic bubbles.

## Recommendations

The findings from this research provided valuable insight for both practice and research. Agricultural communicators should work with land-grant faculty to help them effectively engage members of the public in science communication and break through the academic echo chamber or epistemic bubble. The participants in the study never indicated they viewed their stakeholders' views of science as invalid; instead, they reported simply not engaging outside of their homogenous network. This type of chamber can easily be disrupted by helping faculty engage with appropriate audiences and utilize effective channels. Practitioners can help faculty in science communication by providing professional development opportunities about best practices for different communication platforms, like Twitter, and how to develop a communication program that can reach and resonate with various stakeholder groups. Also, land-grant faculty should seek research opportunities with agricultural communication faculty to understand the needs of their target audience and their preferred communication channels.

Administrators at land-grant universities should also consider the findings of this study to implement support structures for tenure-track faculty to engage in science communication. Administration can offer or encourage classes on science communication to faculty and students while encouraging mentorship to help faculty and future scientists understand how to effectively engage with their target audience. Communication specialists for departments should also be hired to help faculty engage in science communication. Faculty could work with their departmental specialists to understand the best communication channel for their audience or identify opportunities for public engagement. Specialists could also help collaborate with faculty to create press releases, infographics, feature stories, and social media posts to help distribute research beyond peer-reviewed journals.

Future research should further investigate the difference between echo chambers and epistemic bubbles in academia. Additionally, the echo chamber construct developed for this research should be revised to include some of the findings from the qualitative phase of the study and tested again to help increase the validity of the measurement. Adding questions about the faculty's communication channels and information about who they spent time with professionally could help increase the instrument's validity. Researchers should also conduct a content analysis of high science communicators' social media accounts, podcasts, science blogs etc. to gain insight into who their audience actually is and whether or not they are only communicating to those in academia. A social network analysis could also provide valuable information as to who faculty communicate with regularly about their research.

One of the limitations to this study was it was confined to UF/IFAS. Additionally, there was a larger proportion of administrators and social scientists who completed the survey compared to the population. Interviews with some of the non-respondents may increase the generalizability of the study to the population. To better understand the environmental influences on the development of echo chambers, future research should also explore faculty engagement in echo chambers at other land-grant universities as well as non-land grant universities. Additionally, survey and interview questions should be constructed in a way to better understand differences in faculty's engagement in echo chambers versus engagement in epistemic bubbles. Surveying undergraduate and graduate students at these institutions could also provide insight into how the next generation views science communication and their engagement in echo chambers and epistemic bubbles.

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