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Motivational Influences on Land-Grant Faculty Engagement in Science Communication

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Abstract

To address knowledge gaps related to science, faculty will have to effectively engage the public in science communication. This is particularly true at land-grant institutions where tenure-track faculty have appointments in teaching, research, and Extension. However, tenure-track faculty have found it difficult to balance their professional obligations and have struggled to engage the public through Extension efforts. The purpose of this study was to determine how the Expectancy Value Theory (EVT) of Achievement Motivation can explain tenure-track, land-grant faculty's engagement in effective science communication. An online survey instrument was distributed to a census of tenure-track faculty at the University of Florida's Institute of Food and Agricultural Sciences. Respondents had positive or neutral task values associated with science communication, believed they had good ability, and would be successful at science communication in the future. Research appointment, cost belief, and ability beliefs were all predictors of effective science communication and accounted for 64% of the variance in effective science communication. EVT was found to be a useful model in understanding faculty's motivation to engage in science communication. However, perceptions of ability must be addressed, through formal or informal education, if faculty are expected to engage in effective science communication or Extension programming.

Keywords: science communication; land-grant university; faculty; motivation; expectancy-value theory; extension

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Introduction

"As the world becomes increasingly scientific and technological, our future grows more dependent on how wisely humans use science and technology," (Nelson, 1999, para. 3). Unfortunately, not every person has the opportunity to receive formal science education during their time in college. Yet, the average person is expected to make sense of complex, scientific topics facing the world (Takahashi & Tandoc, 2016). To help consumers make informed decisions about these complex issues, scholars and practitioners often rely on public engagement, also known as science communication (Dudo, 2012). Science communication has been simply defined as "communication of science by scientists to people not involved with research in their field" (Pearson, 2001, p. 122).

The concept of communicating research-based information to a non-scientific audience aligns with the purpose of Extension, or outreach, at land-grant institutions (National Institute of Food and Agriculture [NIFA], n.d.). Faculty at these institutions have been expected to engage in teaching, research, and Extension regardless of their formal appointments (Association of Public and Land Grant Universities [APLU], 2012); however, some scholars have argued that land-grant institutions have strayed away from their mission (Colasanti et al., 2009) and lack relevancy in today's society (McDowell, 2001; Schuh, 1993). While these thoughts represent opinions and are somewhat dated, recent literature has found the majority of Americans were unaware that Extension even existed (Settle et al., 2017).

Some of the factors leading to Extension's engagement with the public, or lack thereof, have been traced back to institutional influences. Recent trends at universities have prioritized research above outreach or teaching (Fribourg, 2005). Additionally, faculty have been tasked with securing grants (Minarovic & Mueller, 2000) but have felt it has become increasingly difficult to secure this funding (Funk & Rainie, 2015). Academia has also shifted toward a model of public engagement while keeping an emphasis on securing grants (Higher Learning Commission, 2020). Colleges of agriculture have remained deeply rooted in research, and scientists have reported feeling stressed when it came to fulfilling their duties related to outreach (Weerts & Sandmann, 2010).

This lack of engagement between scientists and the public is troublesome. Audience segments in America have become increasingly skeptical of the impacts higher education can make on the country (Fingerhut, 2017), and scientists have found it more and more difficult to maintain trust with their stakeholders (Ravetz & Saltellie, 2015). Due to this increasing level of skepticism, consumers have expressed doubt in scientifically agreed upon topics, like climate change, yet they still trust university scientists the most to communicate this information (Brewer & Ley, 2013). Scientists, including land-grant faculty, will need to be willing to engage the public in discussions about science to help increase trust in science and decrease knowledge gaps across the public for these complex and critical issues (Bennett & Iyengar, 2008; Blekesaune et al., 2012; Ksiazek et al., 2010; Prior, 2007). Understanding land-grant faculty's motivation to engage in science communication will be vital in helping these institutions engage their stakeholders and support the land-grant mission. The purpose of this study was to determine how the Expectancy Value Theory of Achievement Motivation can explain tenure-track, land-grant faculty's engagement in effective science communication. In accordance with the American Association of Agricultural Education Research Priority Area 1: Public and Policy Maker Understanding of Agricultural and Natural Resources (Enns et al., 2016), the findings from this study provide a framework for land-grant universities and departments of Agricultural Education to facilitate effective science communication between faculty and the public.

Expectancy-Value Theory

John Atkinson (1957) proposed the Expectancy-Value Theory (EVT) of Achievement Motivation to understand how individuals decide to participate in a particular behavior. Atkinson (1957) postulated that a person had to deem a behavior valuable and expect to succeed at accomplishing the task to actually participate in the behavior. However, the value associated with a task is often dependent on the task itself (Schunk, 2012). Contemporary models of EVT have included perceptions of abilities, perceptions of task values, and expectations for success to best represent how people's motivation differs depending on context and perceptions (Wigfield et al., 2009).

An individual's perceptions of abilities related to a specific task or behavior is referred to as his or her self-concepts of abilities. These perceptions will be task specific and not be the same across subject and domain areas (Schunk, 2012). Value has simply been defined in the literature as the "perceived importance of the task" (Schunk, 2012, p. 363). Even though value had a straight-forward definition within in the achievement-motivation model, value was constructed from four components that dictated the value of the task: attainment, intrinsic, utility, and cost belief. Attainment value described the level of importance in succeeding at completing a task (Eccles et al., 1993). The importance described in this context could be due to the task providing opportunity to fulfill social needs or conveying important information about the person. The intrinsic value differs in that it represents the instantaneous satisfaction or enjoyment a person receives from completing the task (Eccles et al.,1993). How the task helps to fulfill future goals is referred to as the utility value. An example would be taking an entrance exam for admittance into a program. The final component of value was termed the cost belief value and was the perceived drawbacks of engaging in the task, like loss of time or money (Wigfield & Eccles, 1992).

Contemporary models for achievement motivation have also included expectancy, or perceived expectation to succeed at the task. This definition differs from perceptions of ability because it is reflective of overall task success. Expectancy for success, perceptions of ability, and task values are proposed mediators between the environmental outcome of a task and achievement.

EVT has traditionally been viewed as an education theory to understand motivation to learn (Schunk, 2012). However, a study by Ruth et al. (2017) used EVT to explore Florida Extension specialists' motivation to participate in public engagement training. The researchers found that faculty with an Extension appointment were not confident in using emerging forms of media, like social media and blogs, to discuss general science and specific research areas; however, they were also not likely to participate in training for these public engagement activities. Ruth et al. (2017) concluded the faculty either did not see the value in the public engagement training or did not think they were capable of successfully participating in that type of engagement.

Faculty Motivation

Other researchers have also explored faculty's engagement in science communication but have not necessarily used the EVT as a framework. Bentley and Kyvik (2011) conducted a literature review on faculty's motivation to engage in science communication and concluded that many believed science communication was an optional activity. Additional barriers to science communication stem from a lack of time and resources (Bentley and Kyvik, 2011; Poliakoff & Webb, 2007) and the belief that tenure and promotion committees do not care about science communication (Weerts & Sandmann, 2010). Similarly, Chaudhary and Radhakrishna (2015) found that land-grant faculty with Extension and research appointments perceived their research should take precedence over their Extension efforts. However, some research has indicated faculty are motivated to engage the public. Lundy et al. (2006) found that faculty at land-grant institutions believed it was part of their duty to participate in science communication. Faculty were also more motivated to engage the public if they believed it would benefit their discipline (Lundy et al., 2006). These studies indicate that utility value and cost belief values were likely predictors of science communication.

Studies have explored other aspects of faculty's motivation to engage in science communication that closely aligned to other variables from EVT. Besley et al. (2012) concluded that personal efficacy and dedication to public good were the strongest predictors of scientists' engagement in science communication. Dudo (2012) found that attitude toward science communication influenced engagement, as did the faculty's experiences with training/education in science communication.

Training experiences offered to faculty in other areas, like teaching and learning, have also been found to be successful in increasing job performance (Roberts et al., 2019). For example, after a semester-long professional development centered on teaching, faculty saw an increase in teaching evaluations (Roberts et al., 2019). These studies reflect concepts of the EVT related to attainment value, intrinsic value, and perceptions of ability.

Some characteristic differences between faculty have also been found to influence science communication. Senior ranked scientists have been found to engage more with the public compared to junior faculty (Jensen et al., 2008). Basic science researchers have also been found to publish their research less in popular press compared to social and applied scientists, likely due to the difficulty they find in translating their research for a broad audience (Dunwoody, 1986; Winter, 2004). Wade and Demb (2009) also suggested demographic characteristics, like gender, age, and race/ethnicity be included in future research on faculty's engagement in science communication. While past research has explored faculty's engagement in science communication, the current study used the EVT of Achievement Motivation to capture a more holistic understanding of tenure-track, land-grant faculty's motivation to engage in Extension through science communication.

Purpose and Objectives

The purpose of this study was to determine how Expectancy Value Theory of Achievement Motivation explained tenure-track, land-grant faculty's engagement in effective science communication. The following objectives guided this study:

1) Describe tenure-track, land-grant faculty's engagement in effective science communication;
2) Describe tenure-track, land-grant faculty's intrinsic value, attainment value, utility value, and cost belief value in science communication;
3) Describe tenure-track, land-grant faculty's perceptions of ability and expectations for success in science communication;
4) Determine the influence of demographic characteristics, academic characteristics, and EVT variables on tenure-track, land-grant faculty's engagement in effective science communication.

Methods

Quantitative methods were used to fulfil the purpose of this study. The population of interest was tenure-track faculty in the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS). Tenure-track faculty were specifically chosen due to the pressures they likely associated with balancing work responsibilities and achieving tenure and promotion (Weerts & Sandmann, 2010). UF is a land-grant university with a mission "to develop knowledge in agricultural, human and natural resources and to make that knowledge accessible to sustain and enhance the quality of human life," (UF/IFAS, 2017, para. 1). The university has contributed to $108.7 billion to Florida's gross domestic economy and is home to 51,000 students in the College of Agricultural and Life Sciences (CALS; UF/IFAS, 2013). Faculty at UF have appointments in at least one of the following areas: Extension, research, and teaching. There was a total of 553 tenure-track faculty (N = 553) in 32 department/programs in UF/IFAS at the time of the study (UF/IFAS, 2013).

Instrumentation

The survey instrument consisted of 45 questions that covered various aspects of faculty's engagement in science communication. The definition for science communication was provided to the respondents and said, "for the purpose of this study, science communication is when researchers engage in meaningful communication with the public about their science." The present article has focused on questions related to the EVT and effective science communication and comes from a larger project that utilized both quantitative and qualitative methods to understand tenure-track faculty's engagement in science communication. The objectives in this study have not been previously reported. The survey instrument was reviewed by a panel of experts and piloted prior to distribution to help strengthen the validity and reliability of the study (Field, 2013). The panel of experts included a research assistant professor with expertise in survey design and instrument development, assistant and associate professors with expertise in science/agricultural communications, an associate professor with expertise in Extension and leadership development, and a professor of horticultural sciences with extensive science communication experience. After the panel made suggestions to improve the validity of the constructs, the instrument was piloted at a peer, land-grant institution. No issues were identified related to the reliability of the constructs of interest and the pilot instrument operated as expected.

The *effective science communication* construct was transformed from two other questions that measured self-reported *quantity of science communication* and *quality of science communication*. The quantity of science communication construct asked respondents how often they had engaged in 15 different public engagement activities over the past year (*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). Examples of public engagement came from the American Association for the Advancement of Science's (AAAS, 2017abcde) website and included posting to social media, delivering a presentation, writing a blog, being interviewed by a reporter, and attending a science café to name a few. The construct was treated as a count variable and could potentially range from 0 (no engagement) to 105 (maximum engagement).

Quality of science communication was measured with a 9-item, 5-point Likert-type scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, and 5 = *strongly agree*). The items determining quality of science communication were adapted from the AAAS' (2017abcde) guidelines for public engagement and were only shown to respondents if they had engaged in at least one science communication activity in the last year. Examples of the items included, "I removed scientific jargon from my presentation," "I provided interactive opportunities with my audience," and "I attempted to establish rapport with my audience prior to talking about my specific research."

Respondents were also given the opportunity to select "Not Applicable" for quality of science communication items that required two-way interaction and would not be practical for all types of public engagement, like writing an opinion column for the newspaper. Not applicable responses were excluded from analysis. The construct was creating by averaging the items and was found to be reliable (Cronbach's $\alpha = 0.77$; Field, 2013).

Quantity of science communication construct was multiplied by quality of science communication construct to create the construct for *effective science communication*. This construct had a potential range of 0 to 525. Please note that this construct has been discussed in a previous study (Ruth et al., 2019). Responses to effective science communication were used to purposively sample participants for a qualitative phase of the project described in Ruth et al. (2019); however, the data were not analyzed in an objective.

Four scales were used to measure *intrinsic value*, *attainment value*, *utility value*, and *cost belief value*. The constructs were all measured on a 5-point, Likert-type scale with the following labels: 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree not disagree*, 4 = *agree*, and 5 = *strongly agree*. Seven items were used to measure *intrinsic value*, which was operationally defined as the enjoyment, interest, or challenge a person experiences when engaging in science communication (Hagemeier & Muraski, 2014; Wigfield, 1994). Examples of the items included: "Engaging in science communication is exciting," and "I enjoy participating in science communication." The reliability was acceptable (Cronbach's $\alpha = 0.89$), and the construct was calculated by summating the items and dividing by seven. To aid in consistently interpreting the findings, real limits were created (Sheskin, 2004). The real limits were 1.00 – 1.49 = *strongly disagree*, 1.50 – 2.49 = *disagree*, 2.50 – 3.49 = *neither agree nor disagree*, 3.50 – 4.49 = *agree*, 4.50 – 5.00 = *strongly agree*. These real limits were also used to interpret attainment value, utility value, and cost belief value.

The *attainment value* measurement was adapted from Wigfield (1994) and Hagemeier and Muraski (2014). The operational definition for attainment value was the self-perceived importance of doing well in science communication for an individual. High attainment value is perceived to reveal important information about the individual or provide opportunity to fulfill social needs (Eccles et al., 1993; Schunk, 2012). Some of the items measuring attainment value included: "I believe engaging in science communication is necessary for me to feel successful," and "Engaging in science communication is not necessary to show I am competent." The five items in the scale were average and the construct was reliable (Cronbach's $\alpha = 0.77$).

Utility value was also adapted from Wigfield (1994) and assessed how useful science communication was for faculty to reach their short and long-term goals. Six items were included in the construct and included statements like, "Engaging in science communication will/did help me with tenure and promotion," and "Science communication is required for my job." The construct was created by summating the items and dividing by six (Cronbach's $\alpha = 0.80$).

Cost belief value was also adapted from Wigfield (1994), but the scenarios presented were adapted from the literature review (Bentley & Kyvik, 2011; Besley et al., 2012; Dudo, 2012; Dunwoody, 1986; Jensen et al., 2008; Lundy et al., 2006; Peters, 2013; Poliakoff & Webb, 207; Weerts & Sandmann, 2010). Cost belief value was defined as what would have to be given up if faculty engaged in science communication (Wigfield & Eccles, 2000). Five items were included in the construct. Some examples were: "Engaging in science communication takes time away from my responsibilities," and "Engaging in science communication will take funds away from my other job responsibilities." Statements were treated so that high perceptions of cost were a five and low perceptions of cost were one. The construct was calculated by averaging the items (Cronbach's $\alpha = 0.82$).

Perceptions of ability were also measured in the survey. Ability beliefs can reflect an individual's current perception of success (Eccles & Wigfield, 1995; Eccles et al., 1993). The scale to measure ability beliefs was adapted from Wigfield and Eccles (2000) and measured with four, 5-point bipolar semantic differential statements. Examples of these statements were "How good are you at science communication? – *not at all good/very good*," and "If you were to list all the faculty in your department from the worst to the best in science communication, where would you place yourself? - *One of the best/one of the worst."* The statements were coded so that positive perceptions of ability were a five and negative perceptions were a one. The construct had a reliability of 0.78. The index was created by averaging the remaining four statements. The real limits for ability beliefs were 1.00 – 1.49 = *very poor ability*, 1.50 – 2.49 = *poor ability*, 2.50 – 3.49 = *acceptable ability*, 3.50 – 4.49 = *good ability*, 4.50 – 5.00 = *very good ability*.

Expectancy for success was the final EVT variable measured in the study. While ability beliefs referred to current perceptions of ability, expectancy accounted for how successful faculty believed they would be at science communication in the future (Eccles & Wigfield, 1995; Eccles et al., 1993). The scale was researcher developed and based on the above definition for expectancy belief. The construct utilized a 4-item, 5-point Likert-type scale with the same labels and real limits as the task value constructs. One example of these statements was, "I will be successful at engaging in science communication in the next year." The items in this construct had a reliability of 0.68, and removal of items did not improve the reliability. While this reliability value does fall short of the typically acceptable 0.70 (Field, 2013), researchers have stated that reliability for psychological constructs can be expected to fall below 0.70 due to the diversity in the items that are measured (Kline, 1999). Additionally, Nunnally (1978) stated that reliability values above 0.50 are acceptable for constructs in the early stages of research. This scale was not edited, and the construct was created by averaging the four items.

Data Collection

An online survey instrument was distributed to a census of tenure-track faculty in UF/IFAS in November of 2017. The data collection procedures followed Dillman's tailored design (Dillman et al., 2014). The survey instrument was open to respondents for 17 days, and respondents received an initial email invitation with a personalized survey link and up to the three follow-up emails inviting them to participate. The survey asked filter questions at the beginning of the instrument to confirm that respondents were tenure-track faculty in UF/IFAS. Answering no to these questions terminated the survey.

Respondents who completed less than 75% of the survey were discarded from analysis. In total, there were 180 (*n* = 180) complete and useable responses (31.6% response rate). The demographics of these respondents can be found in Table 1 along with the demographics of the population. Note that some respondents elected to not answer all demographic question.

The majority of respondents were male, white, and had accrued tenure. Age was measured as a continuous variable, and respondents had an average age of 49.84 (*SD* = 11.65). Additionally, respondents' research, teaching, and Extension appointments were collected. On average, the respondents' had their largest appointment in research (*M* = 47.83%, *SD* = 26.93). Percent appointments in teaching (*M* = 24.97%, *SD* = 24.41) and Extension (*M* = 24.13%, *SD* = 28.09) were relatively even. Respondents also reported their home department, but these were recategorized as social science (Nisbet, 2018), basic science (Ledoux, 2002), and applied science (West, 2018) disciplines to help protect the anonymity of the respondents. The majority of the respondents worked in an applied science discipline (58.9%, *n* = 106), followed by basic sciences (21.7%, *n* = 39) and social sciences (19.4%, *n* = 35).

Table 1
Description of Sample and Population

	Sample	Population
	% (f)	*% (f)*
Gender		
Male	73.3 (132)	72.1 (405)
Female	26.1 (47)	24.7 (139)
Did not respond/Unknown	1.1 (2)	2.7 (15)
Rank (*n* = 178)		
Assistant Professor	31.7 (57)	28.2 (159)
Associate Professor	21.7 (39)	24.2 (136)
Professor	46.1 (83)	43.7 (246)
Unknown	1.1 (2)	3.2 (18)
Academic Discipline		
Applied Science	58.9 (106)	68.4 (378)
Basic Science	21.7 (39)	18.1 (100)
Social Science	19.4 (35)	13.7 (75)
Race/Ethnicity		
White	82.8 (149)	-
Hispanic, Latino, or Spanish Origin	8.3 (15)	-
Asian	6.7 (12)	-
Other	2.2 (4)	-
Black or African American	1.7 (3)	-
American Indian or Alaska Native	1.1 (2)	-
Middle Eastern or North African	0.0 (0)	-
Native Hawaiian of Pacific Islander	0.0 (0)	-

Because the response rate for this study was less than 80%, there was a threat of non-response error (Gall et al., 1996). Non-response errors occur when those who did not answer the survey would answer the questions differently from those who did respond (Dillman et a., 2014). To determine if there was a threat due to non-response, demographics of non-respondents were compared to respondents (Koch & Blohm, 2016, Lewis et al., 2013; Linder et al., 2001). The demographic characteristics of non-respondents were limited to what was publicly available and included discipline, rank, and gender. Chi-square analyses between respondents and non-respondents for rank ($p > .05$) and gender ($p > .05$) were not statistically significant. There appeared to be an association between respondents/non-respondents and discipline ($p = .01$). A larger proportion of respondents were social scientists (19.4%) compared to non-respondents (10.5%). These differences should be considered when interpreting the results as they may inflate positive perceptions of public engagement due to the nature and responsibilities of administration and social scientists.

As an additional measure for non-response error in this study, late respondents were compared to early respondents (Lin & Schafer, 1995; Lindner et al., 2001). For this study, late respondents were identified as the later 50% of respondents and treated as a proxy for non-respondents. A series of independent t-tests were used to compare the early to late respondents' answers for the variables of interest (Lin & Schafer, 1995; Lindner et al., 2001). The independent t-tests showed no significant differences between early and late respondents for variables of interest ($p = .52$). Therefore, non-response errors were considered limited (Koch & Blohm, 2016; Linder et al., 2001).

Data Analysis

Data were analyzed in Statistical Package for the Social Sciences (SPSS) version 25. Simple descriptive statistics were used to fulfill objectives one, two, and three. A linear regression was used to answer objective four. The model included demographic characteristics (age and gender), academic profile information (tenure status, discipline, and research appointment), and the EVT variables. Because gender, tenure status, and discipline were categorical variables, they were dummy coded for analysis. The category with the most cases for each variable was excluded from analysis and treated as the control (i.e. male, tenured, applied science; Field, 2013). Race was not included in the model due to the high proportion of white respondents in the sample, which would likely skew the findings.

Assumptions for multiple regression analysis were met for this study. There were at least 30 cases in each of the categorical variables predicting effective science communication and a large enough sample size to assume the *b*'s would be normally distributed (Field, 2013). Normality was also determined to not be an issue because none of the variables' skewness or kurtosis fell within +/- 2. Multicollinearity was also assessed prior to analysis, which is an issue when two variables share a close relationship to one another. In the initial model, research appointment, Extension appointment, and teaching appointment were all included as predictors. However, these variables' VIF ranged between 6.02 and 7.55 and all had a tolerance below .20, which indicated a potential concern for multicollinearity (Bowerman & O'Connell, 1990; Field, 2013; Menard, 1995). Total appointment apportionments equal 100% and are dependent on one another, which likely caused the multicollinearity issue. Only 21 respondents in the sample did not hold a research appointment, and past research concluded high research appointments could interfere with Extension efforts (Chaudhary & Radhakrishna, 2015), so Extension and teaching appointments were removed from the model as predictors (Field, 2013). After the removal of these predictors, multicollinearity was no longer a concern.

Results

Objective 1

Respondents agreed they used strategies that led to quality science communication with their audience ($M = 3.94$, $SD = 0.51$, $n = 153$). The respondents also indicated they engaged in science communication between zero and 43 times in the past 12 months (M = 13.22, SD = 8.78, n = 180). The means for these constructs were multiplied together to create the effective science communication construct. The range for this variable was from zero to 181.56, with an average of 55.72 (SD = 38.16, n = 180).

Objective 2

Respondents agreed that engaging in science communication had utility value (M = 3.99, SD = 0.64, n = 180) and intrinsic value (M = 3.89, SD = 0.64, n = 179). However, the respondents neither agreed nor disagreed that science communication provided attainment value (M = 3.16, SD = 0.76, n = 180), and disagreed that science communication had a high cost value associated with it (M = 2.33, SD = 0.75, n = 180).

Objective 3

Respondents believed they had a good ability to engage in science communication (M = 3.60, SD = 0.70) and agreed they would be successful in science communication in the future (M = 3.71, SD = 0.55).

Objective 4

Demographic characteristics, academic profile characteristics, and variables EVT variables were included in the regression model. This model was statistically significant (F (12,143) = 8.31, p < .01) and could account for 64% of the total variance in effective science communication (R^2 = .64). Research appointment was a significant predictor of effective science communication, and as research appointment increased, engagement in effective science communication decreased (p = .05, b = -0.21). Cost value and ability beliefs were also predictors. As cost belief increased by one point, effective science communication increased by 10.36 points (p = .01, b = 10.36). Similarly, as ability belief increased by one point, effective science communication increased by 24.43 points (p < .01, b = 24.43).

Table 2
Influences on Effective Science Communication

Variable	*b*	*t*	*p*
Constant	-124.89	-3.66	.00
Non-Tenured	-4.92	-.65	.52
Discipline			
Social Science	.38	.05	.97
Basic Science	2.71	.41	.68
Age	-.19	-.63	.53
Research Appointment	-.21	-1.95	.05*
Gender	3.66	.66	.51
Intrinsic Value	1.36	.25	.80
Attainment Value	3.80	.92	.36
Utility Value	9.21	1.65	.10
Cost Value	10.36	2.52	.01**
Ability Belief	24.43	5.47	.00**
Expectancy Belief	8.70	1.24	.21

* p < .05, ** p < .01

Discussion and Recommendations

The purpose of this study was to determine how EVT of Achievement Motivation predicted tenure-track, land-grant faculty's engagement in effective science communication. Respondents agreed they engaged in quality science communication, like establishing rapport with their audience and removing jargon from presentations (AAAS, 2017). On average, the respondents engaged the public in approximately one science communication activity a month over the past year. When these variables were transformed into the effective science communication construct, the range and standard deviation of the measurement was large. The respondents' engagement in effective science communication illustrated substantial variations in science communication related to both quality and quantity across the sample.

Weerts and Sandmann (2010) had concluded external motivations, like tenure and promotion, influenced faculty's motivation to engage in science communication. However, the researchers had concluded that faculty did not believe tenure and promotion committees cared about science communication (Weerts & Sandmann, 2010), which contradicted the finding that respondents agreed science communication provided a utility value. The faculty in this study were at a land-grant university and would be expected to engage in some type of outreach/Extension (NIFA, n.d.), which may explain this perceived utility value. The respondents in the study may have also perceived a utility value in science communication beyond the tenure and promotion packet related broadly to benefiting their discipline (Lundy et al., 2006).

Respondents to the survey also agreed there was an internal, intrinsic motivation to participating in science communication and disagreed there was a cost belief value in engagement. Past research has indicated time and resources were costs associated with science communication (Bentley and Kyvik, 2011; Poliakoff & Webb, 2007). This discrepancy in findings could represent the shift in academia in recent decades to increase focus on public engagement (Higher Learning Commission, 2020) and acceptance among the faculty. Respondents neither agreed nor disagreed that they associated an attainment value with science communication, which indicated science communication was not important in fulfilling the social needs of tenure-track faculty (Eccles et al., 1983).

Respondents in the study perceived themselves to have good ability when engaging in science communication and expected to be successful in future communication. According to prior literature (Poliakoff & Webb, 2007) and EVT theory (Atkinson, 1957), these faculty would be expected to have a high intent to engage in science communication or Extension efforts. The respondents' responses to the EVT variables contradict Ruth et al.'s (2017) conclusion that faculty did not see the value in science communication or did not believe they were capable of successfully engaging the public. However, this difference may be due to the respondents' characteristics. Winter (2004) had concluded that basic science researchers may believe their research was too difficult for the public to understand. Basic science researchers only made up 20% of the study's sample, which may account for the sample's reported expectations for success.

The influence of demographic characteristics, academic characteristics, and EVT variables on effective science communication was also analyzed in this study. The regression model's large effect size of 0.64 (Cohen, 1988) demonstrated EVT is an appropriate model to use to predict effective science communication.

The significant predictors in the model included research appointment, cost belief, and perceptions of ability. Respondents with large research appointments likely feel pressure to secure grants and publish in top tier journals (Funk & Rainie, 2015; Minarovic & Mueller, 2000), which decreases their engagement in effective science communication. This finding also supports the notion that faculty have trouble balancing their work responsibilities when research appointments are high (Chaudhary & Radhakrishna, 2015; Weerts & Sandmann, 2010). Interestingly, as respondents' cost belief value increased, their engagement in effective science communication increased. This contradicts EVT's (Wiggfield & Eccles, 1992) postulation that as perceived costs increased, engagement in a task decreased. A potential explanation for this finding is that faculty who have participated in science communication often have a greater understanding of the costs associated with science communication compared to those who do not engage as often.

However, more research is necessary to understand how cost belief values influence engagement in effective science communication. The strongest predictor of effective science communication was perceptions of ability. As respondents' perception of ability increased, so did their engagement in effective science communication. This finding is critical for administrators at land-grant universities to be aware of if they want to increase the relevancy of their institution to their stakeholders. While faculty may have positive perceptions of science communication and see value in it, they will not be successful in engaging the public unless they believe they possess the skills necessary to do so.

Recommendations for Practice

The findings from this study are only generalizable to the population of tenure-track faculty in UF/IFAS; however, they can still provide the foundation for both practitioners and researchers to facilitate science communication and Extension programming to address issues like knowledge gaps (Bennett & Iyengar, 2008; Blekesaune et al., 2012; Ksiazek et al., 2010; Prior, 2007) and consumer skepticism toward science (Brewer & Ley, 2013). First and foremost, administrators at land-grant universities should work with departments of agricultural education and communication to provide opportunities and support for faculty to learn about science communication and how to effectively engage in Extension. The faculty likely already see the value in science communication, but they need to believe they will be successful in their efforts to engage the public.

Working with agricultural communicators or other communication specialists to develop workshops, webinars, toolkits, and courses to teach land-grant faculty specific skills to help them engage the public in effective science communication would be beneficial to the faculty. These opportunities could also be offered as a new faculty professional development to help increase perceptions of ability early in their academic career (Roberts et al., 2019). Emphasizing how science communication provides utility and intrinsic value to faculty could also help increase participation in these educational opportunities. Additionally, graduate and undergraduate students studying applied, basic, and social science should enroll in classes related to science communication. Including science communication in students' curriculum could help prepare the next generation of scientists to feel confident in their science communication abilities and facilitate effective Extension programs.

Faculty with high research appointments could also partner with agricultural communications specialists to identify time effective strategies to engage the public. For example, rather than the faculty member traveling around the state to deliver presentations to stakeholders, they could instead work with a member of the communications team at the university to craft a press release about their latest research project. Faculty will need to engage in science communication in some capacity to help consumers make informed decisions related to agricultural and natural resources and fulfill the land-grant mission (APLU, 2012; Dudo, 2012).

Recommendations for Research

The EVT explained a large amount of variance in effective science communication, but there is still room to further explore how this theory can explain tenure-track, land-grant faculty's engagement in effective science communication. Interviews or focus groups could be used to better understand the role of cost belief values in predicting effective science communication. The variable did not act as predicted within the context of effective science communication and should be further investigated. Interviews could also provide a more nuanced understanding of tenure-track, land-grant faculty's intrinsic value, utility value, attainment value, and cost belief values related to science communication. Additionally, asking faculty how they defined Extension, outreach, and science communication would help to identify any differences or overlap between the activities. Understanding these perceived differences/similarities could lead to better guidance for how to report science communication for promotion and tenure in the future.

While demographic and academic characteristics had limited influences on effective science communication, there may be an association between these characteristics and the EVT variables that should be investigated. For example, faculty in different discipline areas may differ in how they value science communication. Research should also examine faculty's actual engagement in effective science communication opposed to their self-reported engagement. To ensure departments with agricultural education, Extension, and communication faculty can support science communication at their home institutions, this study should also be replicated at other land-grant universities to understand contextual influences on tenure-track, land-grant faculty's engagement in effective science communication.

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