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Cover Page Footnote

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Testing Social Media Water Conservation Messages that Convey Extension Evaluation Results

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Abstract. In this study, we tested frames Extension professionals could use to promote residential water conservation through social media. We randomly assigned Florida residents to view one of six visual messages with water conservation facts or stories and then measured willingness to engage with education programs and conservation behaviors. There were clear differences in message frame performance, but better performance was highly dependent on outcome metrics used. Therefore, we were unable to identify a preferred frame. These findings need to be further examined in an authentic social media environment to inform best practices in social media message framing for Extension professionals.

INTRODUCTION

U.S. citizens use 9 billion gallons of water each day on their lawns, much of which is wasted and can be conserved (Environmental Protection Agency, 2013). Floridians use 1,680 million gallons of water per day for household purposes, including household irrigation (Dieter et al., 2017). When Extension programs lead to adoption of good irrigation practices, households can conserve water while maintaining healthy yards and saving money. In 2018, for example, Floridians saved over 386 million gallons of water after participating in educational programs offered by the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS), an amount valued at more than \$1 million in utility bill savings (UF/IFAS, 2019).

Extension professionals working on water issues through various programs encourage residential landscape water conservation using group classes, webinars, individual consultations, site visits, and communication methods such as social media. Social media is becoming increasingly important for Extension professionals (Campbell et al., 2019) and can be used to achieve the land-grant mission, including increasing clients' knowledge and changing behavior (Gharis et al., 2014).

Social media offers a valuable way to present visual imagery. Compared to social media messages with text alone, those containing visuals may appeal more vividly to consumers' senses and strengthen audience engagement and reactions (Childers & Houston, 1984; Lazard & Atkinson,

2015; Villarroel Ordenes et al., 2018). Social media can be used to provide clientele with ample information (Garcia et al., 2018); however, understanding of how to best use this medium is limited, especially in Extension contexts. Researchers agree that strategic communications alone (i.e., through social media) may not directly prompt behavior change but are critical components of educational programs (Warner et al., 2018; Warner et al., 2015). While there are many metrics available to measure social media outcomes (e.g., number of followers or mentions [Gharis et al., 2014]), little research has evaluated strategies to achieve greater impact.

Extension professionals may frame social media messages to engage, educate, and change attitudes of online audiences (Ardoin et al., 2013; Gharis et al., 2014). To date, no research exists examining framing to inform the best way Extension can communicate evaluation impacts through social media, even though research has shown that the way evaluation reports are designed and shared can influence readers' attitudes (Mason & Azzam, 2019). This study applied framing theory to test visual messages, which shared information from UF/IFAS Extension evaluation reports. Frames provide a mechanism for change agents to cognitively organize information around a key idea (i.e., health, wealth, environment) to which a targeted audience may relate (Valenzuela et al., 2017). In this study, we used fact and story frames to characterize visual water conservation messages, comparing consumers' reactions to state level statistical statements (facts) versus narrative-style personal quotes

(stories) about Extension water conservation programming impacts.

PURPOSE AND OBJECTIVES

The purpose was to examine how social media posts containing different message frames (i.e., statewide level factual and household level narrative) conveying Florida water conservation outcomes and impacts could potentially influence viewers. Specific objectives were to examine Floridians' (a) willingness to engage with Extension, (b) interest in learning about water, and (c) willingness to take action—all following a message intervention.

METHODS

We collected quantitative data in November and December of 2018 from an online, opt-in nonprobability sample of Floridians using a researcher developed instrument. Prior to data collection, the University of Florida Institutional Review Board reviewed our protocol for protection of human subjects and granted approval. We used a professional survey sampling company to recruit potential respondents who were Florida residents 18 years and older. From 4,882 potential respondents who belonged to the target audience, 3,596 provided complete responses, for a 73.7% participation rate (Baker et al., 2016). Respondents were randomly assigned to view one of six images (treatment groups; see Table 1) or to receive no treatment (control).

We designed treatments with the same base image portraying residential landscape irrigation and used font size and weight to highlight the most significant parts of each message. We overlaid three images with state level factual statistics drawn from UF/IFAS Extension 2017 water conservation outcomes (Treatments 1–3) and three with

household level, personalized statements in the form of a quotation with a person's silhouette (Treatments 4–6) to reinforce the idea that the quote came from a person (see Figure 1).

Respondents were required to view their assigned image for at least 10 seconds before proceeding to respond to the outcome variables (willingness to engage in Extension educational activities, interest in learning about water topics, and likelihood of engaging in actions to protect water). We measured interest in engaging with Extension by asking respondents to indicate their interest in eight educational opportunities, such as reading an Extension fact sheet. Responses were measured on a 5-point Likert scale with the following response options: *strongly disagree*, *disagree*, *neither disagree nor agree*, *agree*, *strongly agree*. We measured interest in learning about specific water topics with a check all that apply format where respondents could indicate interest in seven water-related topics, such as irrigation practices that save water.

We measured likelihood of taking action by using a 5-point Likert scale where respondents were instructed to, "Please indicate how likely or unlikely you are to engage in the following practices in the future." There were four general actions, such as minimizing the amount of water used taking care of the yard, and six activism-related actions, such as donating to an organization that protects water. Responses included the following options: *very unlikely*, *unlikely*, *undecided*, *likely*, and *very likely*.

We used poststratification weighting methods to overcome limitations associated with nonprobability sampling and ensure responses were representative of the target population (Baker et al., 2013; Kalton & Flores-Cervantes, 2003; Lamm & Lamm, 2019). We used chi-square analyses to determine whether there was a relationship between the treatment and outcome variables. When we

Table 1. Description of Study Treatments

Treatment name	Treatment group	<i>n</i>	Description
Control	C	501	No treatment/message
Gallons statewide fact	Treatment 1	519	Gallons of water saved statewide by UF/IFAS Extension participants in 2017
Financial statewide fact	Treatment 2	489	Dollar value associated with gallons of water saved statewide by UF/IFAS Extension participants in 2017
Increased supply statewide fact	Treatment 3	539	Number of households supplied by gallons of water saved statewide by UF/IFAS Extension participants in 2017
Gallons household story	Treatment 4	487	Quote about individual household level water savings over one year
Financial household story	Treatment 5	541	Quote about individual household level financial water bill savings over one year
Increased supply household story	Treatment 6	519	Quote about households supplied by individual household level water savings over one year

Figure 1. Images used as study treatments.

identified a significant relationship, we used a post hoc modified Bonferroni test to determine which treatment groups were different from one another.

RESULTS

Treatment was related to interest in engaging in three of the eight Extension learning opportunities (see Table 2). Most of the differences among individual treatments were observed as less opposition (indicated by fewer *strongly disagree* or *disagree* responses) and a greater potential openness to learning in a particular way (indicated by *neither disagree nor agree* responses). Group 3 was most likely to express interest in visiting an Extension website to learn more about protecting water compared to two of the other treatment groups. Group 5 was more likely to indicate a neutral stance

about visiting their local Extension office to learn about water compared to the control group and group 2.

Treatment was related to interest in learning about four of the seven water related topics (see Table 3). Group 6 was more interested in learning about irrigation practices that save water compared to the control group and group 1. Group 3 was more interested in learning about water restrictions compared to the control group and group 2. Group 3 was more interested in learning about irrigation management compared to group 2.

Treatment was related to likelihood of engaging in most of the water related actions (see Table 4). Group 2 expressed less opposition to avoiding wastage of water compared to the groups 1 and 5. Group 3 was more likely to visit springs or parks to learn about water compared to group 1. Group 2 indicated more indecision about joining an organization or

Table 2. Chi-Square Analysis of Interest in Engaging with Extension Following Exposure to Randomly Assigned Visual Message Treatment

Response	Treatment							<i>p</i>	χ^2	<i>V</i>
	C	1	2	3	4	5	6			
Visiting an Extension website to learn more about protecting water resources*										
Disagree	25.6	24.8	28.7	21.1	26.0	27.1	25.5	.003	30.04	.07
NDNA	29.6 _{ab}	30.9 _b	25.8 _{ab}	24.7 _{ab}	28.4 _{ab}	29.4 _{ab}	22.1 _a			
Agree	44.8 _{abc}	44.4 _c	45.5 _{abc}	54.2 _b	45.6 _{abc}	43.5 _{ac}	52.3 _{abc}			
Visiting local Extension office to learn about protecting water*										
Disagree	39.8	38.1	39.9	35.4	38.2	32.6	37.4	.023	23.57	.06
NDNA	30.8 _a	36.0 _{ab}	31.0 _a	32.1 _{ab}	35.7 _{ab}	41.1 _b	34.2 _{ab}			
Agree	29.4	25.9	29.1	32.5	26.1	26.4	28.4			
Having a representative of my local Extension office visit my property to help me learn to protect water*										
Disagree	40.9	40.6	46.6	39.7	41.7	39.4	41.0	.038	21.94	.06
NDNA	30.7	34.1	27.6	27.6	33.5	34.3	29.5			
Agree	28.5	25.3	25.8	32.7	24.7	26.4	29.5			
Attending a weekly Extension training to learn more about protecting water										
Disagree	49.4	49.2	52.6	47.9	47.4	46.9	51.3	.166	16.58	.05
NDNA	30.4	32.8	26.8	32.1	34.4	34.1	26.5			
Agree	20.2	17.9	20.6	20.0	18.2	19.0	22.2			
Engaging with my local Extension office's social media sites to learn more about protecting water resources										
Disagree	36.6	37.3	39.2	36.0	35.8	33.7	37.0	.192	15.99	.05
NDNA	30.2	32.6	26.4	26.5	32.3	33.7	30.6			
Agree	33.2	30.1	34.4	37.5	31.9	32.6	32.5			
Receiving an electronic Extension newsletter to learn more about protecting water resources										
Disagree	26.4	28.8	32.0	24.4	28.0	28.4	27.8	.281	14.32	.05
NDNA	30.0	28.6	27.4	27.6	31.7	28.4	26.5			
Agree	43.6	42.7	40.6	48.0	40.3	43.1	45.8			
Attending one-time Extension workshop to learn more about protecting water resources										
Disagree	35.3	37.5	40.1	33.8	36.1	33.7	33.2	.485	11.51	.04
NDNA	28.9	29.9	29.3	29.1	31.2	32.2	32.3			
Agree	35.7	32.6	30.6	37.1	32.7	34.1	34.5			
Reading a fact sheet to learn more about protecting water resources										
Disagree	25.1	19.6	19.4	21.3	19.4	19.4	20.1	.498	11.36	.04
NDNA	28.5	30.3	31.2	27.8	29.9	32.8	29.1			
Agree	46.3	50.1	49.4	50.9	50.7	47.8	50.8			

Note. Numbers correspond to percentages of each treatment group selecting each response. C = Control; Treatment 1 = Gallons Statewide Fact; Treatment 2 = Financial Statewide Fact; Treatment 3 = Increased Supply Statewide Fact; Treatment 4 = Gallons Household Story; Treatment 5 = Financial Household Story; Treatment 6 = Increased Supply Household Story. Cramer's *V* values were interpreted as 0.10 to 0.19 = weak effect (Rea & Parker, 1992). *Strongly* and *somewhat disagree* combined into one category (Disagree) and *Strongly* and *somewhat agree* combined into one category (Agree) to aid data presentation. *Not applicable* responses were excluded from this analysis. Frequencies with different subscript letters indicate subset of treatment groups whose proportions differ from one another at $p = .05$ (p values adjusted using Bonferroni method).

* $p < .05$.

buying a license plate to protect water, compared to group 4 and group 3, respectively. Group 2 was more likely to conserve water taking care of the landscape compared to group 4. Group 1 expressed less opposition to minimizing the water used to take care of their yard compared to the control.

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Through this study, we drew insights into how different water conservation message frames influenced an audience's interest and participation in water issues and educational programs. No treatment had a clear advantage in terms of impact on viewers. Instead, the preferred frame was highly dependent on the outcome metric. If an Extension professional seeks to increase interest in learning about irrigation practices that save water, they would likely choose the increased supply household story frame. With a goal of influencing interest in engaging with Extension, there is promise in using four frames: the gallons statewide fact, financial statewide fact, increased supply statewide fact, and financial household story. The variability in the preferred frame based on outcome metric underscores the need to integrate an intentional social media strategy into an Extension program's planning process. Ideally, Extension professionals should identify social media goals early on, gather feedback, and test different frames with their audiences.

Significant differences in interest among those who viewed the statewide increased supply message in learning more about water on an Extension website and learning more about water restrictions indicate that presenting bigger evaluation impacts can potentially shift people toward seeking greater awareness of water issues. On the other hand, after viewing the increased supply household story message, there was a significant level of interest in learning about irrigation practices to save water, suggesting viewers related to the household level narrative, which may have led to contemplation of household level behavior changes. In these cases, both the household story and statewide fact frames likely grew interest in learning more. Therefore, Extension professionals should design and test messages based on specific intended outcomes, such as household level contemplation or more general awareness of water issues. Further, results indicate that both factual and narrative frames can have impacts and Extension professionals might consider varying communications to include both frames for appealing to a variety of audiences who might be driven by facts or emotions.

Our findings do not suggest people would take action after briefly viewing a social media water conservation visual message. Yet behavior change occurs incrementally, and small shifts in awareness or intention may be the intermediate steps in a complex behavior change journey (Conroy & Allen, 2010; Warner et al., 2014). Our findings imply that people are less opposed to taking action or advocating to protect

Table 3. Chi-Square Analysis of Interest in Learning About Specific Water Topics Following Exposure to Randomly Assigned Visual Message Treatment

Water conservation topic	Treatment							<i>p</i>	χ^2	<i>V</i>
	C	1	2	3	4	5	6			
Irrigation practices that save water*	17.8 _a	17.1 _a	19.2 _{ab}	24.8 _{ab}	22.2 _{ab}	20.9 _{ab}	26.7 _b	.001	23.67	.08
Understanding water restrictions*	14.8 _a	21.3 _{ab}	14.2 _a	22.6 _b	15.7 _{ab}	20.0 _{ab}	18.2 _{ab}	.001	22.46	.08
Private well protection*	9.0	8.8	13.6	13.7	11.6	8.9	9.8	.016	15.64	.07
Irrigation management*	14.4 _{ab}	15.0 _{ab}	13.8 _b	21.1 _a	16.6 _{ab}	14.7 _{ab}	15.2 _{ab}	.025	14.44	.06
Plants that need less water	18.6	21.0	21.2	23.2	21.9	21.1	22.0	.726	3.64	.03
Irrigation technologies that save water	19.0	18.1	16.5	21.3	20.4	18.6	20.6	.484	5.476	.04

Note. Yes responses presented. C = Control; Treatment 1 = Gallons Statewide Fact; Treatment 2 = Financial Statewide Fact; Treatment 3 = Increased Supply Statewide Fact; Treatment 4 = Gallons Household Story; Treatment 5 = Financial Household Story; Treatment 6 = Increased Supply Household Story. Cramer's *V* values were interpreted as 0.10 to 0.19 = weak effect (Rea & Parker, 1992). Frequencies with different subscript indicate subset of treatments whose proportions differ from one another at *p* = .05 (*p* values adjusted using Bonferroni method).

* *p* < .05.

Table 4. Chi-Square Analysis of Likelihood of Engaging in Water Activism Following Exposure to Randomly Assigned Visual Message Treatment

Response	Treatment							<i>p</i>	χ^2	<i>V</i>
	C	1	2	3	4	5	6			
Avoid wasting water when taking care of my yard**										
Unlikely	3.1 _{abcde}	6.0 _{de}	1.8 _c	2.4 _{abcde}	5.7 _{abde}	6.3 _{be}	2.3 _{acd}	< .001	35.30	.07
Undecided	12.1	9.4	9.2	9.6	11.5	8.4	9.2			
Likely	84.8	84.6	89.1	88.0	82.8	85.4	88.5			
Visit springs, lakes, state parks, etc., to learn about water issues*										
Unlikely	18.3 _a	20.7 _{ab}	27.1 _b	21.6 _{ab}	22.2 _{ab}	20.6 _{ab}	21.9 _{ab}	.002	31.70	.07
Undecided	31.9 _a	30.8 _{ab}	26.0 _{ab}	22.7 _b	32.6 _a	30.1 _b	25.4 _b			
Likely	49.8 _{ab}	48.5 _{ab}	46.9 _{ab}	55.7 _b	45.2 _a	49.3 _{ab}	52.7 _{ab}			
Join an organization that protects water*										
Unlikely	42.2	39.4	45.9	38.4	39.6	39.2	41.9	.009	26.70	.06
Undecided	33.3 _{abc}	33.3 _{abc}	25.4 _c	33.1 _{abc}	36.9 _b	31.5 _{abc}	27.2 _{ac}			
Likely	24.5	27.2	28.6	28.5	23.5	29.3	30.9			
Buy a specialty license plate that supports water protection efforts*										
Unlikely	54.0 _{ab}	47.4 _{ab}	57.1 _b	45.3 _a	52.1 _{ab}	47.6 _{ab}	48.4 _{ab}	.019	24.30	.06
Undecided	25.2 _{ab}	27.4 _{ab}	20.3 _b	29.1 _a	25.4 _{ab}	25.5 _{ab}	27.0 _{ab}			
Likely	20.8	25.2	22.6	25.5	22.5	26.9	24.7			
Manage my landscape using the smallest amount of water possible*										
Unlikely	4.1	5.3	3.1	4.6	2.9	6.5	4.7	.021	23.84	.06
Undecided	15.8 _a	9.1 _b	12.1 _{ab}	12.7 _{ab}	14.9 _{ab}	12.3 _{ab}	10.7 _{ab}			
Likely	80.2	85.5	84.8	82.7	82.3	81.2	84.6			
Vote to support water protection programs*										
Unlikely	9.9 _{ab}	5.9 _b	12.3 _a	9.6 _{ab}	12.5 _a	12.1 _a	11.0 _{ab}	.021	23.83	.06
Undecided	16.1	17.0	14.8	13.9	16.7	17.6	13.1			
Likely	74.0	77.0	72.9	76.6	70.8	70.3	75.8			
Conserve water when taking care of my home landscape*										
Unlikely	4.7	2.8	3.1	3.7	4.2	5.3	3.5	.023	23.64	.06
Undecided	13.6 _{abc}	12.0 _{abc}	8.8 _c	10.6 _{abc}	15.5 _b	10.7 _{abc}	8.9 _{ac}			
Likely	81.8 _{abc}	85.2 _{abc}	88.1 _c	85.7 _{bc}	80.3 _b	84.0 _{abc}	87.6 _{ac}			
Minimize the amount of water I use taking care of my yard*										
Unlikely	5.9 _a	4.0 _{ab}	2.0 _b	3.8 _{ab}	4.3 _{ab}	5.3 _{ab}	5.6 _{ab}	.033	22.39	.06
Undecided	14.2	10.7	12.5	12.7	16.7	11.7	11.9			
Likely	79.9	85.2	85.6	83.5	79.0	83.0	82.5			
Donate to an organization that protects water										
Unlikely	33.1	31.1	37.4	31.0	32.6	34.0	32.6	.065	20.12	.05
Undecided	36.9	33.7	31.0	34.4	30.1	33.4	28.5			
Likely	30.0	35.1	31.6	34.6	37.3	32.6	39.0			
Volunteer for a stream cleanup or wetland restoration event										
Unlikely	41.4	39.3	47.5	40.2	41.2	41.9	39.2	.088	19.02	.05
Undecided	30.0	26.6	23.3	28.4	31.1	25.2	27.8			
Likely	28.6	34.1	29.1	31.4	27.7	32.9	33.0			

Note. Numbers correspond to percentages of each treatment selecting each response. *Very likely* and *likely* combined into one category (Likely) and *unlikely* and *very unlikely* combined into one category (Unlikely) to aid data presentation. C = Control; Treatment 1 = Gallons Statewide Fact; Treatment 2 = Financial Statewide Fact; Treatment 3 = Increased Supply Statewide Fact; Treatment 4 = Gallons Household Story; Treatment 5 = Financial Household Story; Treatment 6 = Increased Supply Household Story. Cramer's *V* values were interpreted as 0.10 to 0.19 = weak effect (Rea & Parker, 1992). *Not applicable* responses were excluded from this analysis. Frequencies with different subscript letters indicate subset of treatments whose proportions differ from one another at $p = .05$ (p values adjusted using Bonferroni method).

* $p < .05$. ** $p < .001$.

water after viewing the gallons and financial statewide fact frames. Specifically, people who may have voted against water protection programs or who lacked interest in joining an organization to protect water may shift toward a more neutral stance or be open to learning more. Based on these results, additional testing of visual messages to facilitate water-related advocacy would be valuable, considering different forms of civic action, such as political involvement or engagement with environmental organizations.

Social media can be an effective Extension tool when used thoughtfully and intentionally (Garcia et al., 2018). Much more research is needed to explore how Extension professionals can most effectively frame social media posts, tailor messages for intended audiences, and integrate evaluation data into impactful communications. Our study was situated within a water conservation context, and both the findings and methods are applicable for Extension work being done using social media within any area of focus.

Not surprisingly, the magnitude of relationships we identified through this research was very small, given that we measured outcome variables following a single view of the message. While our findings warrant further research and consideration, the lack of a clear preferred frame highlights the need for future research and the complexity of identifying best practices in social media communication. An additional limitation is the use of an online survey rather than an authentic context. There would likely be differences between a statewide audience responding to an online survey compared to those individuals following a UF/IFAS Extension social media page who would see the message multiple times. For this reason, we recommend a replication of the current study embedded in Extension social media pages on different platforms, to target the true followership.

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