5-2020

Using the Elaboration Likelihood Model as a Method to Teach Science Communication

Ann Briggs
University of Nebraska - Lincoln, ann.wilton14@gmail.com

USING THE ELABORATION LIKELIHOOD MODEL AS A METHOD TO TEACH SCIENCE COMMUNICATION

by

Ann S. Briggs

A THESIS

Presented to the Faculty of
The Graduate College at the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Master of Science

Major: Natural Resource Sciences

Under the Supervision of Professor Mark E. Burbach

Lincoln, Nebraska
May, 2020

USING THE ELABORATION LIKELIHOOD MODEL AS A METHOD TO TEACH SCIENCE COMMUNICATION

Ann S. Briggs, M.S.

University of Nebraska, 2020

Advisor: Mark E. Burbach

For most scientists, researchers, and resource professionals, the act of communicating their science is not the focus of their training or practice. While the importance of sharing information with the general public is widely accepted, many professionals have not been taught how to communicate with the public. They rely on trial and error and other methods that often lead to misunderstanding and miscommunication. Science communication is a necessary step to keep society engaged and informed about science and the scientific process, and a lack of science communication to the public leads to misinformation, and ultimately a lack of trust in scientists.

This study proposes the use of the Elaboration Likelihood Model (ELM) as a method to teach science communication. A training session was created based on the ELM and presented to the Nebraska Water Leaders Academy. Messages communicating science were collected at this training session and analyzed to determine if the ELM is an effective model to improve science communication. This study found that science communication is best analyzed on a person-by-person basis. While the ELM is helpful

in teaching science communication, many other factors including previous knowledge and training may influence the results.

Key words: science communication, elaboration likelihood model

Grant Acknowledgement

Funding for this research was provided by the Nebraska Environmental Trust (NET) through a subaward with the Nebraska State Irrigation Association.

Table of Contents

List of Figures

List of Tables

CHAPTER 1 – INTRODUCTION

Background

At its core, communicating science involves providing scientific information to a public that has various levels of understanding. Science communication has been defined in various ways: "sharing science with non-experts" (Rakedzon et al., 2017, p. 2), "communicating science to non-technical publics" (Sharon & Baram-Tsabari, 2014, p. 528), and ultimately providing people with the information they need in an understandable way in order to make decisions and possibly promote behavior change (de Bruin & Bostrom, 2013). Science communication has been practiced formally and informally for as long as science itself has been practiced, and has been studied formally for almost 100 years (Logan, 2001).

Even so, for most scientists, researchers, and resource professionals, the act of communicating their science is not the focus of their training or practice. While the importance of sharing information with the general public is widely accepted, many professionals have not been taught how to communicate with the public. They rely on trial and error and other methods that often lead to misunderstanding and miscommunication (Bankston & McDowell, 2018).

Science communication is a necessary step to keep society engaged and informed about science and the scientific process (Bankston & McDowell, 2018). As scientists address long-term issues such as climate change and the associated threats to conservation and biodiversity in new and innovative ways, informing the public and garnering large-scale support through communication will be paramount to the success of

these projects (Monto & Malhotra, 2011). A lack of science communication to the public leads to misinformation, and ultimately a lack of trust in scientists (Bankston & McDowell, 2018).

Various methods and models have been introduced to address challenges to science communication. Communication experts suggest addressing jargon and science literacy before applying frames to a message to make it more meaningful to the recipient (Sharon & Baram-Tsabari, 2013, Nisbet & Mooney, 2007). These methods of improving communication are useful and can be applied in various settings. However, knowing exactly how to address jargon, science literacy, and framing requires training of its own. This study seeks to consolidate suggestions for improving science communication into a single model that can be applied to a wide range of topics and circumstances.

The Elaboration Likelihood Model, or ELM, was developed in the field of psychology in 1981 to describe how persuasive communication occurs. The ELM has been applied in various fields since its introduction in the hopes of improving communication with the public in order to change behaviors and attitudes. The ELM is applicable to science communication because it considers characteristics of the message, the recipient, and the sender in order to improve communication.

Statement of the Problem

More often than not scientists, researchers, and resource professionals have received no formal communication training (Bankston & McDowell, 2018). While they may be experts in their field, this gap in communication knowledge and experience creates an ‘expert blind spot’ that can hinder their communication with the public.

Experts feel that no one is listening to their research and therefore no one cares, and the general public begins to characterize scientists as condescending, patronizing, and unreachable (Wiggins & McTughe, 2005). In order to face large-scale problems such as climate change and rapid population growth, experts need to be able to communicate with the public in a way that is effective, persuasive, and creates a space for change to occur. How are experts supposed to do this when they have never been taught? Some people are natural communicators, but even they can benefit from explicit training. This is especially important when communicating to a public that does not want to change their attitudes and behaviors.

Purpose Statement

The purpose of this project is to test a method of improving written science communication. The ELM provides a general framework for organizing, categorizing, and understanding the basic processes underlying the effectiveness of persuasive communications. By applying this model to the field of science communication, this project aims to provide a framework for scientists to improve their written communication with the public. In this study, the ELM will be applied to a training session taught at the Nebraska Water Leaders Academy on written science communication and the pre-training and post-training messages will be analyzed to determine if the communication improved through the use of the ELM. The ELM has been extensively tested in the fields of health care, psychology, digital analytics, and communication. In recent years, this model has been applied to various scientific topics, including agricultural communication and interpretation and education at zoos and nature

preserves. This project seeks to expand the existing literature to consider science communication in the written form while providing a framework to scientists and other resource professionals.

Research Questions

The research question that guided this quantitative study was: Is the Elaboration Likelihood Model an effective model to train scientists and resource professionals to communicate science more effectively and persuasively in a written form? This research question is tested in the context of an ELM-based writing training in the area of water management.

Significance of this Study

Ultimately, this study aims to identify an effective method of training non-professional communicators to share important messages about science with their public. This study provides recommendations to the Nebraska Water Leaders Academy (Academy) participants to better communicate messages about water in Nebraska.

CHAPTER 2 – REVIEW OF THE LITERATURE

Background of the Elaboration Likelihood Model

The Elaboration Likelihood Model (ELM) was first introduced by Petty and Cacioppo in 1981 in their book Attitudes and Persuasion: Classic and Contemporary Approaches. They developed this theory in an effort to address irregularities and questions in attitude and behavior change research in the 1960's and 1970's (Petty & Cacioppo, 1986). In this context, attitude is defined as "a general and enduring positive or negative feeling about some person, object, or issue" (Morris, Woo, & Singh, 2005, p. 80) and "people's general predispositions to evaluate other people, objects, and issues favorably or unfavorably" (Petty, Brinol, & Priester, 2009, p. 127). Overall, at this time attitude was generally defined as evaluative reactions to stimuli (Prister et al., 1999)

Prior to the ELM, most theories of attitude change could be grouped into seven major approaches: 1) conditioning and modelling approaches that focus on the direct effects of rewards and punishments, 2) the message-learning approach that focuses on an individual's attention to, understanding and acceptance of a persuasive message, 3) judgement approaches that focus on past experiences' impacts on attitudinal judgements, 4) motivational approaches that examine the relationship between human motives and attitudinal changes, 5) attributional approaches that focus on the relationship between inferences about self or others and attitudinal changes, 6) combinatory approaches that focus on the integration of information into an overall attitude, and 7) self-persuasion approaches that focus on self-generated information in the presence or absence of a persuasive message (Morris, Woo, & Singh, 2005). With the ELM, Petty and Cacioppo

(1986) sought to simplify attitude-change research and provide an overarching model. The ELM considers how the classic source, message, recipient, and contextual constructs influence persuasion through attitudes (Petty & Wegener, 1999). Petty and Cacioppo expanded on the ELM from 1981 to 1986, addressing different factors within the model and testing their theories. In 1986, Petty and Cacioppo published their completed Elaboration Likelihood Model of Persuasion, a culmination of their work up to that point.

According to the seminal Petty and Cacioppo (1986) publication, the ELM "provides a fairly general framework for organizing, categorizing, and understanding the basic processes underlying the effectiveness of persuasive communications" (Petty & Cacioppo, 1986, p. 125). In this sense, elaboration is defined as topic-related thinking that message recipients undertake while processing a message (O'Keefe, 2013). Elaboration is viewed as a continuum from low to high, or incomplete to complete. Recipients are considered to have low elaboration when no thought is given about the argument present and high or complete elaboration when every argument is considered and then integrated into the recipient's attitudes (Petty & Cacioppo, 1986).

The primary purpose of creating the ELM was to clarify how communication-induced attitude change occurs. Petty and Cacioppo (1986) suggested that persuasion falls into two categories, the central route and the peripheral route. The central route is persuasion that "likely resulted from a person's careful and thoughtful consideration of the true merits of the information presented in support of an advocacy" (p. 125). The central route coincides with high elaboration in message recipients (O'Keefe, 2013). It is widely accepted that attitude changes as a result of the central

route to persuasion are more long-lasting and resistant to change. This is because individuals have taken significant effort to form those attitudes and integrate them with their preexisting belief system (Lazard & Atkinson, 2015). Persuasion through the central route is effective because the recipient uses prior experience and knowledge to evaluate the arguments presented in the message (Marion & Reid, 2007). However, this means that in order for the central route to be possible, the message must have high relevance to the recipient, and that the recipient must have the motivation and ability to process the information included in the argument (Morris, Woo, & Singh, 2005). Therefore, in order to increase elaboration and encourage recipients to take the central route, constructs that increase the likelihood of individual motivation and ability to engage with the information should be included in the message (Petty, Cacioppo, & Goldman, 1981). This means that message content including text, words, and written material used in the message are particularly important (Morris, Woo, & Singh, 2005).

The peripheral route was more likely to occur "as a result of some simple cue in the persuasion context that induced change without necessitating scrutiny of the true merits of the information presented" (Petty & Cacioppo, 1986, p. 125). The peripheral route coincides with low elaboration and occurs when the message has little to no relevance to the recipient (Morris, Woo, & Singh, 2005; Petty et al. 2009). It could also occur when the recipient has a low ability to process the message. These factors suggest that attitude changes formed by way of the peripheral route are less enduring and less likely to hold when questioned (Lazard & Atkinson, 2015; Petty et al., 2009). When the message recipient uses the peripheral route, it often occurs because heuristic principles or

simple decision rules are used rather than elaboration (O'Keefe, 2013). The central and peripheral routes to persuasion are exhibited in Figure 1.

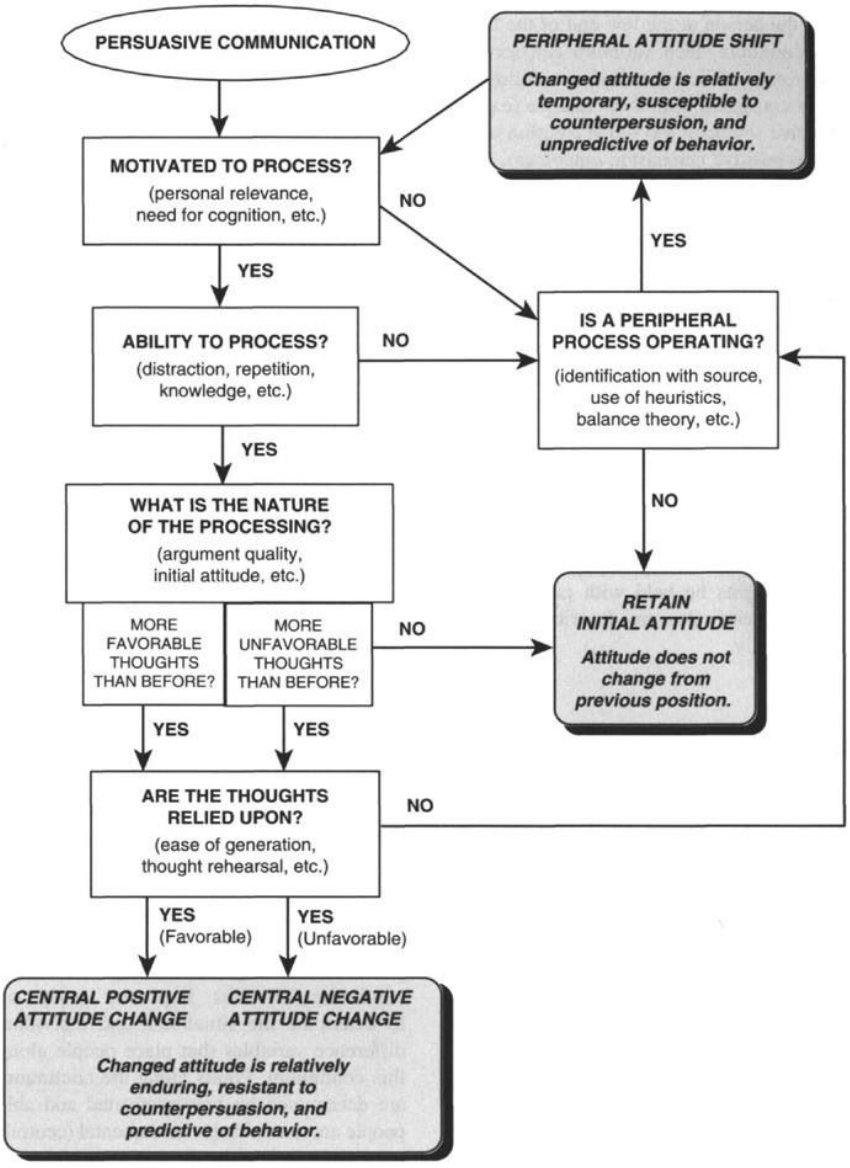


Figure 1. Central and peripheral routes to persuasion (Petty & Cacioppo, 1986)

To summarize the ELM, Petty and Cacioppo (1986) introduced seven postulates, as follows:

1. People are motivated to hold correct attitudes.
2. Although people want to hold correct attitudes, the amount and nature of issue-relevant elaboration in which people are willing or able to engage to evaluate a message vary with individual and situational factors.
3. Constructs can affect the amount and direction of attitude change by: (A) serving as persuasive arguments, (B) serving as peripheral cues, and/or (C) affecting the extent or direction of issue and argument elaboration.
4. Affecting motivation and/or ability to process a message in a relatively objective manner can do so by either enhancing or reducing argument scrutiny.
5. As motivation and/or ability to process arguments is decreased, peripheral cues become relatively more important determinants of persuasion. Conversely, as argument scrutiny is increased, peripheral cues become relatively less important determinants of persuasion.
6. Constructs that affect message processing in a relatively biased manner can produce either a positive (favorable) or negative (unfavorable) motivational and/or ability bias to the issue-relevant thoughts attempted.
7. Attitude changes that result mostly from processing issue-relevant arguments (central route) will show greater temporal persistence, greater prediction of behavior, and greater resistance to counter persuasion than attitude changes that result mostly from peripheral cues.

These postulates are based on assumptions explained further by Petty and Cacioppo (1986) and defended by Petty and Wegener (1999). While these postulates may not apply in all circumstances, they are generally accepted as factors that support the understanding and use of the ELM.

Evaluating the effectiveness of persuasive communications can be a nebulous concept. Petty and Wegener clarified this thought in 1999, stating that "The ELM is a theory about the processes underlying changes in judgements of objects, the constructs that induce these processes, and the strength of the judgements resulting from these processes" (Petty & Wegener, 1999, p. 42). Overall, the ELM suggests that attitude change is mostly reached through cognition rather than emotion (Morris, Woo, & Singh, 2005). It is important to note that the characteristics and level of persuasion differ between recipients and that constructs may play different roles in persuasion depending on the source of the message and the recipient (O'Keefe, 2013).

Critiques of the Elaboration Likelihood Model

As persuasion and attitude change can be indefinite concepts, several researchers have questioned different aspects of the ELM. Petty addresses a few common critiques in 1999 in conjunction with Wegener. According to Petty and Wegener, one of the most commonly criticized elements of the ELM is found in the elaboration continuum. Viewing elaboration as a continuum from low to high suggests that higher elaboration makes the recipient more likely to change their attitude, and yet attitude changes can occur from both low elaboration and high elaboration. Many factors are involved in attitude change, and many more factors influence the longevity of that attitude change

(Petty & Wegener, 1999). The individual characteristics of the recipient, as well as their motivation to elaborate at that specific time, greatly influence attitude change and are therefore difficult to study in a precise manner.

The idea that individual constructs can have multiple roles along the elaboration continuum has also been challenged. Almost as a mirror to the irregularities of attitude change research in the 1960's and 1970's, critics of the ELM question how the core persuasion constructs (source, message, recipient, and contextual) can serve as arguments, serve as cues, determine the extent of elaboration, and produce a bias in elaboration within the same message. Essentially, Petty and Wegener (1999) suggest that "variables serve as cues at the low end of the elaboration continuum" (p. 51) and "variables serve as arguments or bias information processing at the high end of the elaboration continuum" (p. 51). In the end, the ELM returns to the concept that the characteristics of the message recipient greatly influence how the message is received and elaborated on, as well as how each construct (source, message, recipient, and contextual) act within a message (Petty & Wegener, 1999).

Morris, Woo, and Singh (2005) criticize the ELM for removing affect or feelings from the attitude change process. The central route considers message content including text, words, and written material, while the peripheral route considers message cues including color use and other visuals. This suggests that affect is only associated with the peripheral route, which is said to be taken when the message has little to no relevance to the receiver. Morris, Woo, and Singh criticize the ELM for removing affect from the

central route and therefore from messages that have high relevance to the receiver (Morris, Woo, & Singh, 2005).

In the field of advertising design and implementation, practitioners and academics caution against using the ELM a priori, suggesting rather that it was created for post hoc analysis and using it before launching campaigns may place those campaigns in a 1980's lens since that's when the model was introduced (Kitchen & Kerr, 2014). Overall, critics suggest the ELM be used as the extensive literature suggests and with consideration to the specific factors and constructs involved in the study at hand.

While the ELM at its core is based on attitude change research, this study recognizes that written communication is more likely to increase knowledge without resulting in long-lasting behavior change. True attitude or behavioral change involves knowledge of issues, knowledge of action strategies, locus of control, attitudes, verbal commitment, and an individual sense of responsibility (Kollmuss & Agyeman, 2010).

Applications of the Elaboration Likelihood Model

Historically, the ELM has been applied in the fields of healthcare, advertising and marketing, e-commerce, digital media, and information technology, and science. The following section provides a brief overview of these fields and include how the ELM is used, tested, and applied.

The Elaboration Likelihood Model in healthcare. In the field of healthcare, the ELM has been introduced as a "framework for interpreting and predicting the impact that health communications have on subsequent attitudes and behavior" (Petty, Barden, & Wheeler 2009, p. 22). The ELM is particularly useful in healthcare because the issues are

often highly relevant to the message recipients, encouraging them to practice high elaboration and take the central route. Angst and Agarwal (2009) demonstrate this with their study. They used the ELM to increase enrollment in electronic health records even when privacy concerns were present. They stated that "even when people have high concerns for privacy, their attitudes can be positively altered with appropriate message framing" (Angst & Agarwal, 2009, p. 339). By using issue involvement and argument framing tactics outlined in the ELM, Angst and Agarwal were able to address the concerns message recipients had, increase elaboration of the message, and ultimately increase volunteer enrollment in electronic health record programs.

The Elaboration Likelihood Model in advertising and marketing. The elaboration likelihood model can be effectively applied to advertising and marketing because the ultimate goal is to change the consumer's attitude in order to change their behavior. Scholars have seen the potential in this field and more than 125 articles and chapters about the ELM have been published in advertising and marketing literature since 1981 (Kitchen & Kerr, 2014). Overall, the effectiveness of advertising is believed to be moderated by audience involvement (Greenwald & Leavitt, 1984). While not exhaustive, the publications described below provide a brief overview of the applications of the ELM in this field.

Greenwald and Leavitt conducted a study in 1984 to determine the four levels of audience involvement in advertising. These levels from low to high are preattention, focal attention, comprehension, and elaboration. The use of elaboration in this sense is based on the ELM, stating that the message recipient not only receives the message but

also thinks extensively about the message content. This can be particularly useful in advertising and marketing because elaboration "results in increasingly durable cognitive and attitudinal effects" (Greenwald & Leavitt, 1984, p. 581). Whatever product is being sold or behavior change is being promoted, by reaching audiences at the highest level of involvement companies can improve the longevity of their message and the related attitudinal change.

In 1986 Moore, Hausknecht, and Thamodaran conducted a study that considered time compression in advertisements. Time compressed ads "increase the speed of audiovisual messages without altering voice pitch" (Moore, Hausknecht, & Thamodaran, 1986, p. 85). This is done by companies to save money and include more information in a smaller amount of time. The ELM suggests that time compression would not be a useful tool for advertisements because it reduces attention to individual components of the ad, making elaboration more difficult. Time compressed ads often utilize the peripheral route to inform and persuade the audience and rely heavily on non-content cues. Ultimately, time compression is not a useful tool to encourage longevity in attitude and behavior change (Moore, Hausknecht, & Thamodaran, 1986)..

The Elaboration Likelihood Model in digital media and information technology. Applications of the ELM in digital media and information technology can appear very similar to applications in advertising and marketing. However, having a solely online platform can change the way information is presented. Another factor to consider is that digital media and information technology aren't always focused on the audience as a consumer. Information can be presented with the purpose to inform and

persuade without necessarily being tied to a purchase. The following examples exhibit applications of the ELM in this wide field.

Petty, Brinol, and Priester (2009) suggest the ELM can be applied as "a general framework that can be used to understand the processes responsible for mass media attitude change" (p. 125). The purpose of mass media communications created by companies is often to change people's attitudes and influence their behavior (Petty, Brinol, & Priester, 2009). Therefore, the ELM can be applied to almost all digital media to analyze current methods and increase effectiveness in the future.

Battacherjee and Sanford (2006) suggest the ELM be used in information technology research for similar reasons as Petty, Brinol, and Priester (2009). Their study used the ELM to understand influence processes in information technology acceptance in companies and how those factors influenced potential users.

In 1999, Priester et al. conducted a study examining the sleeper effect in digital media. In most cases, audiences are more persuaded right after receiving a message and that level of persuasion and the subsequent attitude change decays over time. When the sleeper effect occurs, the persuasive impact of a message increases over time rather than decaying. Priester et al. (1999) argue that the ELM can support the sleeper effect because the ELM suggests that a long time attitude change is more likely to occur when the recipient has been motivated to consider the content of the message more deeply. Therefore, the longer the recipient elaborates on the message, the stronger their attitude will become. The sleeper effect can occur in various digital media and information technology examples, but is more common when the persuasive message has a high

initial impact or when a message that was initially distrusted becomes widespread (for example, when content in speeches given by politicians becomes mainstream ideas that are no longer associated with that politician). The sleeper effect is important to consider when evaluating persuasive messages because the true results of the study might not be apparent until weeks or months later.

Finally, Geddes and the Interaction Design Foundation (2016) make suggestions for effective website design based on the ELM. They suggest appealing to users via both central and peripheral processing routes on web pages and other digital media in order to engage a larger number of users. Geddes states "If the message succeeds in persuading them (such as an effective web page that engages and informs), these users will follow through with a call to action. Their behavior will be more enduring and less likely to be changed. However, they may change again if they process another convincing argument". ELM components that are useful for website design include focusing on content, functionalities, and shorter sections of text, and including links to additional information and videos in order to appeal to all users (Geddes, 2016).

The Elaboration Likelihood Model in science communication. The elaboration likelihood model has been applied in various ways in the field of science communication. The following is a brief overview of the applications most relevant to this study.

Arp (2018) used the ELM as a theoretical foundation to study the relationship between preexisting values regarding genetically modified organisms (GMOs) and how those attitudes influence potential attitude changes. Arp found that "attitude accessibility,

agricultural identity, and in some cases biospheric value orientation were the most important predictors for a number of constructs related to GMO attitudes" (p. viii). In this study, the ELM was used as a model to determine which factors were most useful in changing attitudes based on existing values.

Brossard, Lewenstein, and Bonney (2005) used the ELM as a framework to analyze the impact of The Birdhouse Network, a citizen science project, on participants' attitudes towards science and the environment. Their study found no significant change in participants' attitudes towards science and the environment and suggest that citizen science projects must be explicit about the environmental issues the participants are experiencing in order to encourage any attitude or behavior change.

The ELM is also useful to evaluate interpretation at zoos and other conservation-oriented sites. MacDonald, Milfont, and Gavin (2016) conducted a study at the Wellington Zoo in New Zealand to determine if training animal interpreters in ELM methods of communication would increase visitor satisfaction. They stated that "a two-phase ELM training program, which instructed staff in techniques to increase cognitive processing to visitors, led to increased visitor satisfaction after one training program and increased relevance and elaboration after a second training session" (p. 866). Their study employed a very similar experimental design to our own.

Marion and Reid (2007) used the ELM to determine the efficacy of low impact education programs focusing on minimizing visitor impacts to protected areas. Low impact education programs studied include Leave No Trace, Codes of Conduct, and Environmental Guidelines for Tourists. They focused on the central and peripheral

routes of persuasion and stated that "protected area managers frequently base educational messages on the central route to persuasion, which relied on visitor attention, consideration, and internalization of the message" (p. 11). The central route is particularly useful to persuade visitors in protected areas because the issue is already relevant to the audience, making it more likely that they will elaborate on the message.

Kim, Airey, and Szivas (2010) conducted a similar study at the Lulworth coastal area in England. They surveyed visitors with the purpose of identifying the strengths and weaknesses of site-based interpretation on influencing attitudes and behaviors. They used the ELM to understand the "complex relationships among various factors that lead to different outcomes of interpretive programs" (p. 2) and based the constructs used in their study on the components of the central and peripheral route. They concluded that the results of interpretation are tied to many different factors and individual visitors can have very different responses, as the ELM suggests.

Lazard and Atkinson (2015) focused on the use of environmental infographics in communication that seeks to promote pro-environmental behaviors. The ELM was used as a theoretical framework to analyze persuasive messages. While the ELM traditionally considers visual elements as part of the peripheral route, Lazard and Atkinson found that "visual cues can and are processed as central elements of the message" (p. 27), especially when images and text are used in conjunction. Ultimately, this study suggests that infographics and other visual methods of communication can be effectively used to promote pro-environmental behaviors.

Finally, Winter and Kramer (2012) consider the ELM in terms of digital science communication. They tested whether the principles of the ELM can be effectively applied to science-based blog posts. Based on the ELM, they tested author credibility and content to "predict whether better-quality arguments and individuals' need for cognition affected their content selections" (p. 80). They found that audiences generally preferred content from authors with greater perceived expertise that included 2-sided messages.

Studies in many fields have been based on the ELM since it was introduced in 1981. As such, the above represent a small sampling of the available literature with the intention of demonstrating the breadth of applications this model has.

Theoretical Framework

The theoretical framework of this study was based on the ELM as conceptualized by Angst and Agarwal (2009). This study was selected as a basis because the researcher considered similar aspects of the ELM and tested those aspects in a similar way. Relationships between hypotheses are depicted in Figure 2.

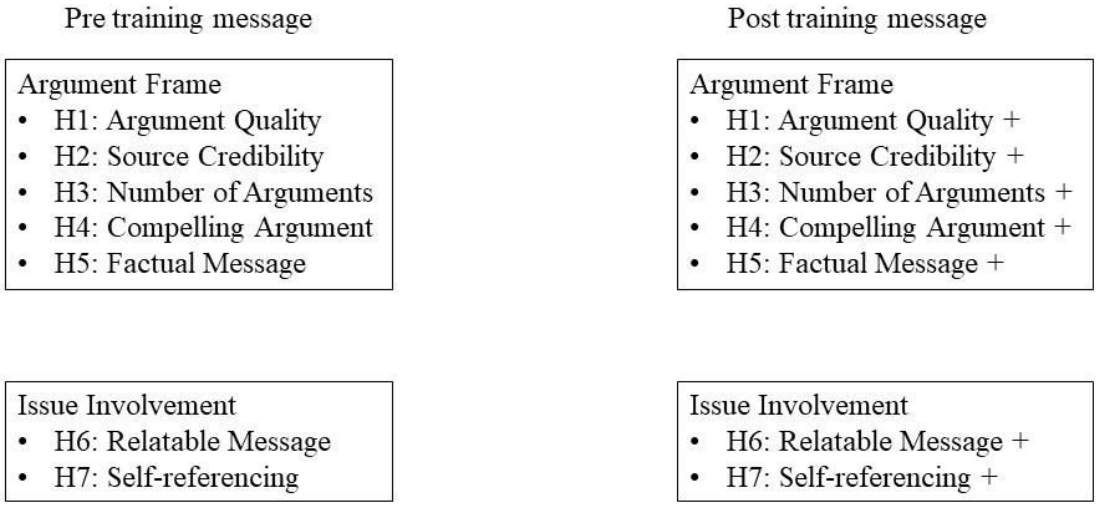


Figure 2. Theoretical framework.

Hypotheses

Hypotheses for this study were developed based on the literature presented above, and specifically Angst and Agarwal (2009) and MacDonald, Milfont, and Gavin (2016). These two studies in particular formed the basis of this study's experimental design because they tested similar components of the ELM through the use of a questionnaire and ultimately examined the influence of messages on attitudes and behaviors of the general public. Hypotheses for this study are summarized below:

H1: The post-training argument quality will be rated significantly higher than the pre-training argument quality.

H2: The post-training source credibility will be rated significantly higher than the pre-training source credibility.

H3: The post-training number of arguments will be rated significantly higher than the pre-training number of arguments.

H4: The post-training compelling arguments will be rated significantly higher than the pre-training compelling arguments.

H5: The post-training factual message will be rated significantly higher than the pre-training factual message.

H6: The post-training relatable message will be rated significantly higher than the pre-training relatable message.

H7: The post-training self-referencing will be rated significantly higher than the pre-training self-referencing.

The above hypotheses represent selected constructs of the ELM. Through the testing of these constructs, this study will extrapolate that increases in each individual factor of the ELM included in the training session would indicate that the ELM provides an effective model for written science communication.

CHAPTER 3 – METHODS

Overview

Both quantitative and qualitative methods have been used to test the persuasive effectiveness of messages that use the Elaboration Likelihood Model (ELM). This study employed a quantitative design so the messages being tested could be empirically rated and the individual factors of the ELM that were relevant to this study could be statistically evaluated.

As part of their program, fourteen 2019 Nebraska Water Leaders Academy (Academy) participants generated pre- and post-training messages about one of the following assigned topics.

Topic 1: Increasing stream flow

Topic 2: Groundwater quality as a result of agricultural practices

Topic 3: Building new infrastructure (e.g. dams and levees) for urban flood management

These topics were selected because they are related to water in Nebraska and were covered in the prior coursework of the Academy. Selecting topics that were covered in the coursework ensured all participants were familiar enough with the topic to write persuasive messages without the need for extensive research.

The Academy is a "year-long program to learn the principles of first-rate leadership and about the vital role of rivers, streams, and aquifers in Nebraska" (Nebraska State Irrigation Association, 2020). The Academy began in 2011 and has graduated 138 participants through nine classes. The Academy meets six times a year in

locations across the state, providing experiences and information about the various water resources in Nebraska. The Academy was a fitting partnership for this study because the participants are experts in their field and frequently communicate with the public, but generally are not trained communicators.

Before the session began, Academy participants were asked to rank the topics from what they were most interested in writing about to what they were least interested in writing about. The topics were assigned following those preferences as closely as possible. An even number of participants were assigned to each topic, but participants were given an opportunity to write about a topic they were familiar with and that was relevant to them.

During the session participants were given fifteen minutes to write a persuasive message about their assigned topic. Their messages then were collected and participants attended a twenty-minute training session based on the ELM framework (Angst & Agarwal, 2009) to improve written science communication. Directly following the training session, the Academy participants were given fifteen minutes to write another persuasive message about the same topic using the methods taught in the training. Notes for the training session can be found in Appendix E.

Following the training session, a Qualtrics web survey was created in which respondents would rate each of the writing examples on multiple ELM concepts including the persuasiveness of the message based on argument quality, source credibility, number of arguments, compelling arguments, factual messages, and relatable message. The survey also asked respondents how familiar they were with the topic in the

message and how relatable the topic was to their daily life. Each respondent was randomly assigned four messages in total to rate, two pre-training messages and two post-training messages. Message assignment was meant to ensure that all messages created by the Academy participants were rated the same number of times and that raters received messages with different topics and from different authors.

Data Collection and Analysis

Message ratings using the Qualtrics survey were collected through Amazon's Mechanical Turk, or MTurk. MTurk began in 2005 as a crowdsourcing tool to complete labor intensive digital tasks and has expanded to become a pool of subjects for experimental research (Paolacci et al., 2010). Advantages of using MTurk to gather data for behavioral research include "easy access to a large, stable, and diverse subject pool, the low cost of doing experiments, and faster iteration between developing theory and executing experiments" (Mason & Suri, 2012, p. 1). Nguyen et al. (2019) suggest using MTurk for ELM research because it "allows cost-effective sampling of subjects who are fitting for a study using ELM, as the subjects are expected to have low motivation in the context of the simulation task" (Nguyen et al., 2019, p. 4). For a more in-depth review of MTurk's demographic characteristics and main features and services, see Paolacci et al. (2010). Ultimately, MTurk was selected for this study to be used as a research tool rather than a population representation.

MTurk raters were shown the following description of the project: "Follow an external survey link to rate messages on science communication. This survey will be used as part of a master's thesis research. At the end of the survey you will receive a code to

paste into the box below to receive credit for taking our survey." They were then provided with a link to the Qualtrics survey. The full survey can be found in Appendix C.

Statistical Analysis

All statistical analyses were conducted using SPSS. This included independent sample t tests and Krippendorff's alpha. The statistical analysis used in this study are discussed further in Chapter 4.

Survey Instrument Design

This study used Angst and Agarwal (2009) as a basis for designing the survey instrument. The purpose of Angst and Agarwal's study was to "determine if individuals can be persuaded to change their attitudes and opt-in behavioral intentions toward EHRs (electronic health records), and allow their medical information to be digitized even in the presence of significant privacy concerns" (p. 339). Their instrument was based on the ELM and current literature about privacy. Angst and Agarwal included issue involvement, multidimensional issue involvement, argument quality, source credibility, factual messages, number of messages, prior knowledge, message repetition, media type, and distractions in their instrument. The results of their study state that their instrument is both valid and reliable, making it an effective basis for this study.

The ELM includes many factors and can be tested through several methods in multiple circumstances. The following constructs were selected to test the effectiveness of the created messages. Other constructs were not considered because they did not apply to this study (e.g., some focus on communication that is not written, some focus on

attitude change over a longer period of time, and others focus on message recipients that are highly involved in the topic being addressed). This study analyzed argument quality, source credibility, number of arguments, compelling arguments, factual messages, and relatable messages. The following is an overview of each individual construct. For a more in-depth description of how each construct was tested and example items, see the questionnaire in Appendix C.

Argument quality. Angst and Agarwal (2009) suggest that "argument quality positively influences perceived usefulness of information" (p. 344). They reference Bhattacherjee and Sanford (2006) and Sussman and Siegal (2003) as support for this construct. Bhattacherjee and Sanford (2006) define argument quality as "the persuasive strength of arguments embedded in an informational message" (p. 811). Sussman and Siegal (2003) state that "the ELM identifies argument quality as the critical determinant of information influence under conditions of high elaboration likelihood" (p. 8). The literature as a whole suggests that improving argument quality will lead to improved persuasive communication.

Four variables were created to analyze argument quality: informative, helpful, valuable, and persuasive. These variables were scaled by finding the mean score, with a range of potential values from zero to four.

Source credibility. Angst and Agarwal (2009) state that "source credibility positively influences perceived usefulness of information" (p. 344). In cases of low motivation, perceived source expertise acts as a simple acceptance or rejection cue. Bhattacherjee and Sanford (2006) define source credibility as "the extent to which an

information source is perceived to be believable, competent, and trustworthy by information recipients" (p. 811). Source credibility is a peripheral cue and "refers to a message recipient's perception of the credibility of the message source, reflecting nothing about the message itself" (Sussman & Siegal, 2003, p. 9). The impact of source credibility depends on the involvement of the recipient. When the recipient is highly involved in the message topic, source credibility has little impact on attitude change. When the recipient is not involved in the topic, source credibility has a greater impact on attitude change (Sussman & Siegal, 2003).

Four variables were created to analyze source credibility: knowledgeable, trustworthy, credible, and expert. These variables were scaled by finding the mean score, with a range of potential values from zero to four.

Number of arguments. Angst and Agarwal (2009) suggest that in cases of low involvement, "people agreed with messages more when more arguments were presented" (p. 345). Haugtvedt and Petty (1992) categorize number of arguments as a peripheral cue because the message recipient isn't necessarily considering the content of the message itself, but are looking at external factors including length and the number of arguments the recipient can remember. In their 1984 article, Petty and Cacioppo state: "when the conditions in a persuasion setting suppress the elaboration likelihood, then the number of arguments for a recommendation can serve as a simple cue" (p. 674).

One variable was created to analyze the number of arguments. The range of potential values was zero to four.

Compelling arguments. Angst and Agarwal (2009) state that in cases of high involvement, "more arguments led to more persuasion when the arguments were compelling, but to less persuasion when the arguments were specious" (p. 345). They reference Haugtvedt and Petty (1992) and Petty and Cacioppo (1984) as support for this construct. In contrast to the number of arguments, these studies suggest that in cases of high involvement, if the arguments are not compelling the message may lead to lower elaboration and persuasion.

Three variables were created to analyze compelling arguments: compelling, convincing, and engaging. These variables were scaled by finding the mean score, with a range of potential values from zero to four.

Factual message. Angst and Agarwal (2009) suggest that "factual messages are more believable and more persuasive, particularly for high involvement people" (p. 345). This statement is supported by Ford et al. (1990) and Puto and Wells (1984).

Three variables were created to analyze factual message: accurate, credible, and valid. These variables were scaled by finding the mean score, with a range of potential values from zero to four.

Relatable message. Angst and Agarwal (2009) state that "elaboration on information is greater when people can relate the information to themselves and to their own experience" (p. 344). Studies by Petty and Cacioppo (1980) and Meyers-Levy (1991) support the use of this construct in an ELM study.

Three variables were created to analyze relatable message: relatable, personally identify with the information, and personally connect with the ideas. These variables were scaled by finding the mean score, with a range of potential values from zero to four.

Self-referencing. Angst and Agarwal (2009) state that "when motivation is low, self-referencing has no effect on elaboration or persuasion" (p. 344). Self-referencing is defined as "the processing of information by relating it to the self-structure or aspects of it" (Burnkrant & Unnava, 1995, p. 17). Studies by Petty and Cacioppo (1980) and Meyers-Levy (1991) support the use of this construct in an ELM study.

Two variables were created to analyze self-referencing: reflection on yourself and your experiences and reflection on your community. These variables were scaled by finding the mean score, with a range of potential values from zero to four.

CHAPTER 4 – RESULTS AND FINDINGS

Overview

An initial 1,250 responses to the survey described in Chapter 3 and detailed further in Appendix C were collected through Amazon's MTurk. MTurk is discussed further in Chapter 3. From these responses, 107 were deemed unfit for analysis either because the MTurk rater did not agree to the informed consent form or they completed the survey in less than five seconds. A secondary phase was completed to recruit an additional 107 responses, for a total of 1,250 survey responses.

No demographic data was collected from the survey takers. Since this study used MTurk as a research tool and not as a representative sample to reflect a population, demographic information was not collected..

Of the 1,250 responses collected, 1,011 responses were included in the analysis. Two hundred thirty-nine responses were removed from the data because the survey takers failed to complete the survey properly. For the purpose of this study, failing to complete the survey properly included providing the same value for each answer or completing the survey in less than four minutes. Four minutes was selected as the minimum time to complete the survey because each rater received four paragraphs to read. The researcher wanted to ensure that the messages were fully read and the raters had an opportunity to fully comprehend the questions, so responses that did not take adequate time were removed from the analysis.

Interrater Reliability

Krippendorff's alpha was used to determine interrater reliability. Krippendorff's alpha was selected over other measurements because of its ability to function through multiple coders and a large sample size. Krippendorff's alpha has a potential range from zero to one. De Swert (2012) suggests an alpha of 0.80 or higher for meaningful conclusions, with an alpha of .67 or higher recognized as the lowest limit for meaningful conclusions. This study calculated Krippendorff's alpha for each pre and post question. The full results are reported in Appendix A. This study's alpha scores ranged from 0.0067 to 0.2258, meaning the overall interrater reliability was poor.

Hypothesis testing

The SPSS program was used to analyze all hypotheses. The researcher compared the pre-training means to the post-training means using a two-tailed independent sample t-test. An independent sample t-test was used because it is a common method to statistically compare means from two different groups while allowing each construct to be considered individually. Simply comparing pre-training and post-training means for each construct was not indicative of the true results captured because each construct included differences in topic, author, and raters. In order to account for the many factors that influenced the results of this study, results were analyzed, and hypotheses tested, in terms of topic and author. The results of the independent sample t test are shown in tables 1 through 14 below.

H1: The post-training argument quality will be rated significantly higher than the pre-training argument quality.

The results by topic indicate for messages written about topic 1 (increasing streamflow) that the pre-training argument quality was rated significantly higher than the post-training argument quality. This result rejects the hypothesis and accepts the null hypothesis. Results by topic are shown in Table 1.

Table 1: *Topic results for hypothesis 1*

	N	**M**	**SD**	**t**	**df**	**Sig.**	**Cohen's d**
Topic 1 – Pre-training	661	2.62	0.734	2.382	1304	0.017	0.09
Topic 1 – Post-training	645	2.55	0.838				
Topic 2 – Pre-training	658	2.85	0.737	0.611	1342	0.541	0.03
Topic 2 – Post-training	686	2.82	0.905				
Topic 3 – Pre-training	672	2.91	0.691	-0.941	1325	0.347	-0.05
Topic 3 – Post-training	655	2.95	0.719				

Note: $p < .05$

The results by topic indicate for messages written about topic 2 (groundwater quality as a result of agricultural practices) that the pre-training argument quality was rated higher than the post-training argument quality, but this difference was not significant (Table 1).

The results by topic indicate for messages written about topic 3 (building new infrastructure for urban flood management) that the pre-training argument quality was rated lower than the post-training argument quality, but this difference was not significant (Table 1).

The results by author indicate for authors 1, 6, 8, 9, and 11 that the pre-training argument quality was rated significantly lower than the post-training argument quality. This result accepts the hypothesis. Results by author are shown in Table 2.

Table 2: *Author results for hypothesis 1*.

	N	M	SD	t	df	Sig.	Cohen's D
Author 1 – Pre-training	158	2.72	0.687	-4.851	314	0.000	-0.54
Author 1 – Post-training	158	3.11	0.721				
Author 6 – Pre-training	136	2.87	0.709	-2.943	259	0.004	-0.37
Author 6 – Post-training	125	3.12	0.629				
Author 8 – Pre-training	128	2.90	0.751	-2.099	274	0.037	-0.25
Author 8 – Post-training	148	3.09	0.711				
Author 9 – Pre-training	124	3.04	0.703	-4.806	261	0.000	-0.59
Author 9 – Post-training	139	3.44	0.650				
Author 11 – Pre-training	135	2.73	0.692	-2.313	268	0.021	-0.28
Author 11 – Post-training	135	2.93	0.703				
Author 10- Pre-training	133	2.96	0.701	-1.871	263	0.062	-0.23
Author 10- Post-training	132	3.12	0.730				
Author 12- Pre-training	133	3.07	0.642	-1.757	264	0.080	-0.22
Author 12- Post-training	133	3.21	0.649				
Author 3 – Pre-training	162	2.84	0.733	4.114	320	0.000	0.46
Author 3 – Post-training	160	2.50	0.748				
Author 4 – Pre-training	174	2.42	0.777	4.063	326	0.000	0.45
Author 4 – Post-training	154	2.06	0.821				
Author 5 – Pre-training	127	2.80	0.650	7.810	259	0.000	0.96
Author 5 – Post-training	134	2.07	0.846				
Author 7 – Pre-training	143	2.65	0.810	2.750	281	0.006	0.33
Author 7 – Post-training	140	2.38	0.872				
Author 14- Pre-training	135	2.84	0.704	2.322	264	0.021	0.28
Author 14- Post-training	131	2.63	0.711				
Author 2 – Pre-training	167	2.52	0.665	1.621	338	0.106	0.18
Author 2 – Post-training	173	2.40	0.725				
Author 13- Pre-training	136	2.97	0.673	1.564	258	0.119	0.19
Author 13- Post-training	124	2.84	0.656				

Note: $p < .05$

The results by author indicate that for authors 10 and 12 the pre-training argument quality was rated lower than the post-training argument quality, but this difference was not significant (Table 2).

The results by author indicate that for authors 3, 4, 5, 7, and 14 the pre-training argument quality was rated significantly higher than the post-training argument quality. This result rejects the hypothesis and accepts the null hypothesis (Table 2).

The results by author indicate for authors 2 and 13 that the pre-training argument quality was rated higher than the post-training argument quality, but this difference was not significant (Table 2).

H2: The post-training source credibility will be rated significantly higher than the pre-training source credibility.

The results by topic indicate for messages written about topic 1 (increasing streamflow) that the pre-training source credibility was rated significantly higher than the post-training source credibility. This result rejects the hypothesis and supports the null hypothesis. Results by topic are shown in Table 3.

Table 3: *Topic results for hypothesis 2*

	N	**M**	**SD**	**t**	**df**	**Sig.**	**Cohen's d**
Topic 1 – Pre-training	655	2.77	0.696	3.624	1306	0.000	0.20
Topic 1 – Post-training	653	2.63	0.765				
Topic 2 – Pre-training	662	2.85	0.711	0.086	1344	0.931	0.00
Topic 2 – Post-training	684	2.85	0.865				
Topic 3 – Pre-training	669	2.92	0.675	-0.254	1326	0.799	-0.01
Topic 3 – Post-training	659	2.93	0.682				

Note: $p < .05$

The results by topic indicate that for messages written about topic 2 (groundwater quality as a result of agricultural practices) the pre-training source credibility was rated higher than the post-training source credibility, but this difference was not significant (Table 3).

The results by topic indicate that for messages written about topic 3 (building new infrastructure for urban flood management) the pre-training source credibility was rated lower than the post-training source credibility, but this difference was not significant (Table 3).

The results by author indicate that for authors 1, 6, 8, 9, and 10 the pre-training source credibility was rated significantly lower than the post-training source credibility. This result accepts the hypothesis. Results by author are shown in Table 4.

Table 4: *Author results for hypothesis 2*

	N	**M**	**SD**	**t**	**df**	**Sig.**	**Cohen's d**
Author 1 – Pre-training	158	2.80	0.667	-3.734	310	0.000	-0.42
Author 1 – Post-training	154	3.09	0.691				
Author 6 – Pre-training	135	2.87	0.662	-3.703	259	0.000	-0.46
Author 6 – Post-training	126	3.17	0.613				
Author 8 – Pre-training	130	2.86	0.734	-2.043	275	0.042	-0.25
Author 8 – Post-training	147	3.05	0.743				
Author 9 – Pre-training	125	3.06	0.700	-4.815	259	0.000	-0.59
Author 9 – Post-training	136	3.45	0.609				
Author 10 – Pre-training	132	2.96	0.636	-2.440	261	0.015	-0.30
Author 10 – Post-training	131	3.16	0.656				
Author 11 – Pre-training	133	2.76	0.709	-1.225	266	0.222	-0.15
Author 11 – Post-training	135	2.87	0.674				
Author 12 – Pre-training	134	3.04	0.691	-1.616	267	0.107	-0.20
Author 12 – Post-training	135	3.17	0.599				
Author 2 – Pre-training	167	2.65	0.690	2.404	341	0.017	0.26
Author 2 – Post-training	176	2.47	0.650				
Author 3 – Pre-training	160	2.96	0.683	2.921	322	0.004	0.33
Author 3 – Post-training	164	2.74	0.664				
Author 4 – Pre-training	170	2.69	0.705	5.639	327	0.000	0.62
Author 4 – Post-training	159	2.23	0.789				
Author 5 – Pre-training	126	2.84	0.620	7.843	259	0.000	0.98
Author 5 – Post-training	135	2.15	0.792				
Author 7 – Pre-training	146	2.64	0.766	2.224	284	0.027	0.26
Author 7 – Post-training	140	2.43	0.816				

Author 14 – Pre-training	135	2.88	0.664	2.901	267	0.004	0.35
Author 14 – Post-training	134	2.64	0.690				
Author 13 – Pre-training	135	2.94	0.650	1.803	257	0.073	0.22
Author 13 – Post-training	124	2.80	0.631				

Note: $p < .05$

The results by author indicate that for authors 11 and 12 the pre-training source credibility was rated lower than the post-training source credibility, but this difference was not significant (Table 4).

The results by author indicate that for authors 2, 3, 4, 5, 7, and 14 the pre-training source credibility was rated significantly higher than the post-training source credibility. This result rejects the hypothesis and accepts the null hypothesis (Table 4).

The results by author indicate that for author 13 the pre-training source credibility was rated higher than the post-training source credibility, but this difference was not significant (Table 4).

H3: The post-training number of arguments will be rated significantly higher than the pre-training number of arguments.

The results by topic indicate for messages written about topic 1 (increasing streamflow) and topic 2 (groundwater quality as a result of agricultural practices) that the pre-training number of arguments was rated higher than the post-training number of arguments, but this difference was not significant. Results by topic are shown in Table 5.

Table 5: *Topic results for hypothesis 3*

	N	**M**	**SD**	**t**	**df**	**Sig.**	**Cohen's d**
Topic 1 – Pre-training	668	2.67	0.891	1.646	1327	0.100	0.09
Topic 1 – Post-training	661	2.58	1.057				
Topic 2 – Pre-training	671	2.87	0.831	0.205	1362	0.838	0.01
Topic 2 – Post-training	693	2.86	1.033				

Topic 3 – Pre-training	681	2.97	0.795	-0.355	1345	0.723	-0.02
Topic 3 – Post-training	666	2.99	0.850				

Note: $p < .05$

The results by topic indicate that for messages written about topic 3 (building new infrastructure for urban flood management) the pre-training number of arguments was rated lower than the post-training number of arguments, but this difference was not significant (Table 5).

The results by author indicate that for authors 1, 6, 9, and 10 the pre-training number of arguments was rated significantly lower than the post-training number of arguments. This result accepts the hypothesis. Results by author are shown in Table 6.

Table 6: *Author results for hypothesis 3*

	N	**M**	**SD**	**t**	**df**	**Sig.**	**Cohen's d**
Author 1 – Pre-training	161	2.87	0.807	-4.970	318	0.000	-0.56
Author 1 – Post-training	159	3.31	0.771				
Author 6 – Pre-training	135	2.87	0.662	-3.175	263	0.002	-0.46
Author 6 – Post-training	126	3.17	0.613				
Author 9 – Pre-training	128	3.07	0.805	-4.287	266	0.000	-0.53
Author 9 – Post-training	140	3.48	0.754				
Author 10 – Pre-training	134	2.94	0.763	-2.105	265	0.036	-0.25
Author 10 – Post-training	133	3.14	0.809				
Author 8 – Pre-training	131	3.06	0.782	-1.510	277	0.132	-0.18
Author 8 – Post-training	148	3.21	0.851				
Author 11 – Pre-training	135	2.87	0.901	-1.275	271	0.204	-0.16
Author 11 – Post-training	138	3.01	0.824				
Author 12 – Pre-training	138	3.22	0.725	-0.566	271	0.572	-0.07
Author 12 – Post-training	135	3.27	0.717				
Author 2 – Pre-training	167	2.51	0.904	2.393	342	0.017	0.25
Author 2 – Post-training	177	2.27	0.979				
Author 3 – Pre-training	165	2.87	0.820	2.857	327	0.005	0.31
Author 3 – Post-training	164	2.59	0.996				
Author 4 – Pre-training	175	2.45	0.938	2.180	334	0.030	0.25
Author 4 – Post-training	161	2.20	1.085				

Author 5 – Pre-training	129	2.71	0.804	6.151	263	0.000	0.77
Author 5 – Post-training	136	1.99	1.058				
Author 7 – Pre-training	147	2.72	0.850	2.341	285	0.020	0.27
Author 7 – Post-training	140	2.47	0.955				
Author 14 – Pre-training	136	2.80	0.778	2.211	269	0.028	0.26
Author 14 – Post-training	135	2.58	0.885				
Author 13 – Pre-training	138	3.02	0.740	0.791	261	0.430	0.10
Author 13 – Post-training	125	2.94	0.855				

Note: $p < .05$

The results by author indicate for authors 8, 11, and 12 that the pre-training number of arguments was rated lower than the post-training number of arguments, but this difference was not significant (Table 6).

The results by author indicate for authors 2, 3, 4, 5, 7, and 14 that the pre-training number of arguments was rated significantly higher than the post-training number of arguments. This result rejects the hypothesis and accepts the null hypothesis. (Table 6).

The results by author indicate for author 13 that the pre-training number of arguments was rated higher than the post-training number of arguments, but this difference was not significant (Table 6).

H4: The post-training compelling arguments will be rated significantly higher than the pre-training compelling arguments.

The results by topic indicate that for messages written about topic 1 (increasing streamflow) and topic 2 (groundwater quality as a result of agricultural practices) the pre-training compelling arguments was rated higher than the post-training compelling arguments, but this difference was not significant. Results by topic are shown in Table 7.

Table 7: *Topic results for hypothesis 4*

	N	**M**	**SD**	**t**	**df**	**Sig.**	**Cohen's d**

Topic 1 – Pre-training	661	2.49	0.807	0.976	1312	0.329	0.05
Topic 1 – Post-training	653	2.45	0.881				
Topic 2 – Pre-training	665	2.74	0.778	0.150	1346	0.881	0.01
Topic 2 – Post-training	683	2.73	0.910				
Topic 3 – Pre-training	674	2.82	0.731	-0.61	1321	0.538	-0.03
Topic 3 – Post-training	649	2.84	0.773				

Note: $p < .05$

The results by topic indicate that for messages written about topic 3 (building new infrastructure for urban flood management) the pre-training compelling arguments was rated lower than the post-training compelling arguments, but this difference was not significant (Table 7).

The results by author indicate that for authors 1, 6, and 9 the pre-training compelling arguments was rated significantly lower than the post-training compelling arguments. This result accepts the hypothesis. Results by author are shown in Table 8.

Table 8: *Author results for hypothesis 4*

	N	**M**	**SD**	**t**	**df**	**Sig.**	**Cohen's d**
Author 1 – Pre-training	159	2.63	0.754	-4.882	316	0.000	-0.55
Author 1 – Post-training	159	3.04	0.769				
Author 6 – Pre-training	134	2.73	0.726	-3.462	258	0.001	-0.43
Author 6 – Post-training	126	3.02	0.631				
Author 9 – Pre-training	127	2.92	0.774	-3.396	262	0.001	-0.42
Author 9 – Post-training	137	3.23	0.695				
Author 8 – Pre-training	129	2.80	0.776	-1.714	273	0.088	-0.21
Author 8 – Post-training	146	2.97	0.804				
Author 10 – Pre-training	132	2.88	0.689	-1.377	259	0.170	-0.17
Author 10 – Post-training	129	3.01	0.765				
Author 11 – Pre-training	133	2.70	0.766	-0.725	266	0.469	-0.09
Author 11 – Post-training	135	2.76	0.728				
Author 12 – Pre-training	135	2.95	0.715	-1.570	267	0.118	-0.19
Author 12 – Post-training	134	3.09	0.737				
Author 3 – Pre-training	161	2.68	0.812	3.190	322	0.002	0.35
Author 3 – Post-training	163	2.39	0.828				
Author 5 – Pre-training	128	2.75	0.732	6.971	260	0.000	0.86
Author 5 – Post-training	134	2.05	0.868				

Author 2 – Pre-training	167	2.41	0.755	1.630	339	0.104	0.18
Author 2 – Post-training	174	2.27	0.798				
Author 4 – Pre-training	174	2.28	0.840	1.945	329	0.053	0.21
Author 4 – Post-training	157	2.10	0.837				
Author 7 – Pre-training	147	2.53	0.828	1.311	285	0.191	0.15
Author 7 – Post-training	140	2.39	0.950				
Author 13 – Pre-training	137	2.84	0.722	1.051	254	0.294	0.13
Author 13 – Post-training	119	2.75	0.775				
Author 14 – Pre-training	137	2.70	0.735	1.228	267	0.220	0.15
Author 14 – Post-training	132	2.59	0.762				

Note: $p < .05$

The results by author indicate that for authors 8, 10, 11, and 12 the pre-training compelling arguments was rated lower than the post-training compelling arguments, but this difference was not significant (Table 8).

The results by author indicate that for authors 3 and 5 the pre-training compelling arguments was rated significantly higher than the post-training compelling arguments. This result rejects the hypothesis and accepts the null hypothesis (Table 8).

The results by author indicate that for authors 2, 4, 7, 13, and 14 the pre-training compelling arguments was rated higher than the post-training compelling arguments, but this difference was not significant (Table 8).

H5: The post-training factual message will be rated significantly higher than the pre-training factual message.

The results by topic indicate that for messages written about topic 1 (increasing streamflow) the pre-training factual message was rated significantly higher than the post-training factual message. This result rejects the hypothesis and supports the null hypothesis. Results by topic are shown in Table 9.

Table 9: *Topic results for hypothesis 5*

	N	M	SD	t	df	Sig.	Cohen's d
Topic 1 – Pre-training	660	2.79	0.625	2.033	1313	0.042	0.11
Topic 1 – Post-training	655	2.71	0.725				
Topic 2 – Pre-training	664	2.95	0.654	1.471	1351	0.142	0.08
Topic 2 – Post-training	689	2.90	0.777				
Topic 3 – Pre-training	673	2.99	0.638	0.475	1328	0.635	0.03
Topic 3 – Post-training	657	2.97	0.657				

Note: $p < .05$

The results by topic indicate that for messages written about topic 2 (groundwater quality as a result of agricultural practices) the pre-training factual message was rated higher than the post-training factual message, but this difference was not significant (Table 9).

The results by topic indicate that for messages written about topic 3 (building new infrastructure for urban flood management) the pre-training factual message was rated lower than the post-training factual message, but this difference was not significant (Table 9).

The results by author indicate that for authors 1, 6, and 9 the pre-training factual message was rated significantly lower than the post-training factual message. This result accepts the hypothesis. Results by author are shown in Table 10.

Table 10: *Author results for hypothesis 5*

	N	M	SD	t	df	Sig.	Cohen's d
Author 1 – Pre-training	159	2.88	0.622	-2.747	315	0.006	-0.27
Author 1 – Post- training	158	3.08	0.684				
Author 6 – Pre-training	133	2.95	0.584	-2.777	258	0.006	-0.41
Author 6 – Post-training	127	3.14	0.575				
Author 9 – Pre-training	127	3.05	0.682	-2.784	264	0.006	-0.34
Author 9 – Post-training	139	3.28	0.666				

Author 8 – Pre-training	130	2.95	0.695	-0.865	275	0.388	-0.10
Author 8 – Post-training	147	3.02	0.708				
Author 10 – Pre-training	134	3.03	0.604	-1.281	263	0.201	-0.16
Author 10 – Post-training	131	3.13	0.635				
Author 11 – Pre-training	134	2.93	0.642	-0.664	269	0.507	-0.08
Author 11 – Post-training	137	2.98	0.599				
Author 12 – Pre-training	135	3.05	0.676	-0.899	268	0.369	-0.11
Author 12 – Post-training	135	3.12	0.630				
Author 4 – Pre-training	172	2.67	0.648	4.349	329	0.000	0.48
Author 4 – Post-training	159	2.34	0.709				
Author 5 – Pre-training	129	2.98	0.630	6.132	263	0.000	0.76
Author 5 – Post-training	136	2.45	0.757				
Author 7 – Pre-training	145	2.86	0.663	3.101	283	0.002	0.37
Author 7 – Post-training	140	2.58	0.808				
Author 14 – Pre-training	134	2.98	0.634	3.363	265	0.001	0.41
Author 14 – Post-training	133	2.70	0.693				
Author 2 – Pre-training	166	2.73	0.565	1.204	338	0.229	0.13
Author 2 – Post-training	174	2.65	0.676				
Author 3 – Pre-training	163	2.89	0.637	1.453	325	0.147	0.16
Author 3 – Post-training	164	2.78	0.645				
Author 13 – Pre-training	136	2.96	0.633	0.438	255	0.662	0.05
Author 13 – Post-training	121	2.92	0.641				

Note: $p < .05$

The results by author indicate that for authors 8, 10, 11, and 12 the pre-training factual message was rated lower than the post-training factual message, but this difference was not significant (Table 10).

The results by author indicate that for authors 4, 5, 7, and 14 the pre-training factual message was rated significantly higher than the post-training factual message. This result rejects the hypothesis and supports the null hypothesis (Table 10).

The results by author indicate that for authors 2, 3, and 13 the pre-training factual message was rated higher than the post-training factual message, but this difference was not significant (Table 10).

H6: The post-training relatable message will be rated significantly higher than the pre-training relatable message.

The results by topic indicate that for messages written about topic 1 (increasing streamflow) and topic 2 (groundwater quality as a result of agricultural practices) the pre-training relatable message was rated higher than the post-training relatable message, but this difference was not significant. Results by topic are shown in Table 11.

Table 11: *Topic results for hypothesis 6*

	N	M	SD	t	df	Sig.	Cohen's d
Topic 1 – Pre-training	664	2.38	0.837	0.196	1315	0.845	0.01
Topic 1 – Post-training	653	2.37	0.886				
Topic 2 – Pre-training	664	2.61	0.787	0.026	1350	0.980	0.00
Topic 2 – Post-training	688	2.61	0.823				
Topic 3 – Pre-training	674	2.64	0.755	-0.310	1334	0.757	-0.17
Topic 3 – Post-training	662	2.65	0.796				

Note: $p < .05$

The results by topic indicate that for messages written about topic 3 (building new infrastructure for urban flood management) the pre-training relatable message was rated lower than the post-training relatable message, but this difference was not significant (Table 11).

The results by author indicate that for authors 1, 6, and 9 the pre-training relatable message was rated significantly lower than the post-training relatable message. This result accepts the hypothesis. Results by author are shown in Table 12.

Table 12: *Author results for hypothesis 6*

	N	M	SD	t	df	Sig.	Cohen's d
Author 1 – Pre-training	159	2.54	0.762	-2.572	312	0.011	-0.29
Author 1 – Post-training	155	2.78	0.846				

Author 6 – Pre-training	134	2.48	0.769	-2.742	258	0.007	-0.34
Author 6 – Post-training	126	2.73	0.665				
Author 9 – Pre-training	124	2.66	0.760	-2.468	261	0.014	-0.31
Author 9 – Post-training	139	2.89	0.734				
Author 8 – Pre-training	130	2.72	0.797	-0.821	276	0.413	-0.10
Author 8 – Post-training	148	2.80	0.787				
Author 10 – Pre-training	131	2.61	0.786	-1.817	262	0.070	-0.22
Author 10 – Post-training	133	2.78	0.790				
Author 11 – Pre-training	135	2.64	0.709	-0.138	271	0.891	-0.02
Author 11 – Post-training	138	2.65	0.795				
Author 12 – Pre-training	135	2.64	0.811	-0.836	266	0.404	-0.10
Author 12 – Post-training	133	2.72	0.801				
Author 3 – Pre-training	164	2.45	0.862	2.074	326	0.039	0.23
Author 3 – Post-training	164	2.25	0.912				
Author 5 – Pre-training	129	2.67	0.742	4.330	263	0.000	0.48
Author 5 – Post-training	136	2.25	0.812				
Author 2 – Pre-training	167	2.37	0.789	0.381	340	0.703	0.04
Author 2 – Post-training	175	2.34	0.786				
Author 4 – Pre-training	174	2.18	0.886	0.364	331	0.716	0.04
Author 4 – Post-training	159	2.14	0.878				
Author 7 – Pre-training	147	2.54	0.842	1.631	284	0.104	0.19
Author 7 – Post-training	139	2.37	0.899				
Author 13 – Pre-training	137	2.69	0.729	1.311	259	0.191	0.16
Author 13 – Post-training	124	2.57	0.788				
Author 14 – Pre-training	136	2.61	0.743	268	0.36	0.085	0.11
Author 14 – Post-training	134	2.52	0.790		1		

Note: $p < .05$

The results by author indicate that for authors 8, 10, 11, and 12 the pre-training relatable message was rated lower than the post-training relatable message, but this difference was not significant (Table 12).

The results by author indicate that for authors 3 and 5 the pre-training relatable message was rated significantly higher than the post-training relatable message. This result rejects the hypothesis and accepts the null hypothesis (Table 12).

The results by author indicate that for authors 2, 4, 7, 13, and 14 the pre-training relatable message was rated higher than the post-training relatable message, but this difference was not significant (Table 12).

H7: The post-training self-referencing will be rated significantly higher than the pre-training self-referencing.

The results by topic indicate that for messages written about topic 1 (increasing streamflow) and topic 2 (groundwater quality as a result of agricultural practices) the pre-training self-referencing was rated higher than the post-training self-referencing, but this difference was not significant. Results by topic are shown in Table 13.

Table 13: *Topic results for hypothesis 7*

	N	**M**	**SD**	**t**	**df**	**Sig.**	**Cohen's d**
Topic 1 – Pre-training	664	2.28	0.916	0.113	1318	0.910	0.01
Topic 1 – Post-training	656	2.27	0.924				
Topic 2 – Pre-training	669	2.46	0.867	-1.127	1354	0.260	-0.06
Topic 2 – Post-training	687	2.51	0.902				
Topic 3 – Pre-training	678	2.49	0.867	-1.791	1335	0.074	-0.10
Topic 3 – Post-training	659	2.57	0.879				

Note: $p < .05$

The results by topic indicate that for messages written about topic 3 (building new infrastructure for urban flood management) the pre-training self-referencing was rated lower than the post-training self-referencing, but this difference was not significant (Table 13).

The results by author indicate that for authors 1, 6, and 9 the pre-training self-referencing was rated significantly lower than the post-training self-referencing. This result accepts the hypothesis. Results by author are shown in Table 14.

Table 14: *Author results for hypothesis 7*

	N	M	SD	t	df	Sig.	Cohen's d
Author 1 – Pre-training	159	2.43	0.880	-1.806	316	0.072	-0.20
Author 1 – Post-training	159	2.61	0.921				
Author 6 – Pre-training	134	2.48	0.768	-1.973	258	0.050	-0.34
Author 6 – Post-training	126	2.73	0.665				
Author 9 – Pre-training	127	2.55	0.824	-1.961	264	0.051	-0.24
Author 9 – Post-training	139	2.75	0.867				
Author 8 – Pre-training	131	2.54	0.874	-1.646	277	0.101	-0.20
Author 8 – Post-training	148	2.71	0.854				
Author 10 – Pre-training	134	2.52	0.868	-1.565	265	0.119	-0.19
Author 10 – Post-training	133	2.69	0.861				
Author 11 – Pre-training	134	2.44	0.852	-1.070	269	0.285	-0.13
Author 11 – Post-training	137	2.55	0.907				
Author 12 – Pre-training	137	2.56	0.846	-1.307	268	0.192	-0.16
Author 12 – Post-training	133	2.70	0.925				
Author 5 – Pre-training	129	2.50	0.829	2.837	262	0.005	0.35
Author 5 – Post-training	135	2.19	0.906				
Author 2 – Pre-training	168	2.26	0.887	0.244	342	0.807	0.03
Author 2 – Post-training	176	2.24	0.888				
Author 3 – Pre-training	165	2.28	0.945	1.145	325	0.253	0.13
Author 3 – Post-training	162	2.17	0.919				
Author 4 – Pre-training	172	2.14	0.933	0.700	329	0.484	0.08
Author 4 – Post-training	159	2.07	0.886				
Author 7 – Pre-training	147	2.35	0.935	0.358	285	0.721	0.04
Author 7 – Post-training	140	2.31	0.924				
Author 13 – Pre-training	138	2.51	0.870	-0.243	261	0.808	-0.03
Author 13 – Post-training	125	2.54	0.857				
Author 14 – Pre-training	135	2.41	0.902	0.207	264	0.836	0.03
Author 14 – Post-training	131	2.38	0.814				

Note: $p < .05$

The results by author indicate that for authors 8, 10, 11, and 12 the pre-training self-referencing was rated lower than the post-training self-referencing, but this difference was not significant (Table 14).

The results by author indicate that for author 5 the pre-training self-referencing was rated significantly higher than the post-training self-referencing. This result rejects the hypothesis and accepts the null hypothesis (Table 14).

The results by author indicate that for authors 2, 3, 4, 7, 13, and 14 the pre-training self-referencing was rated higher than the post-training self-referencing, but this difference was not significant (Table 14).

CHAPTER 5 – DISCUSSION

Introduction: Discussion of Results and Findings

The results of this study are most clear when considered by topic and by author. The results for topic 1 (increasing stream flow) indicate that the post-training messages were rated lower than the pre-training message, with argument quality, source credibility, and factual message significantly so. The results for topic 2 (groundwater quality as a result of agricultural practices) indicate that the post-training messages were rated lower than the pre-training message, but these results were not significant. The results for topic 3 (building new infrastructure for urban flood management) indicate that the post-training messages were rated higher than the pre-training messages, but these results were not significant. To fully understand the results, consideration needs to be given to the results by author. This information is embedded within the results by topic and ultimately influences it.

Fifty percent of the authors (authors 1, 6, 8, 9, 10, 11, and 12) received post-training ratings that were higher than their pre-training ratings. The results from these seven authors support our hypotheses that the training would increase the scores their messages received, meaning that their written communication skills improved after the training session. Different authors had different levels of significance within their scores, which are discussed at length in Chapter 4. These seven authors all received higher ratings post-training than pre-training for all seven constructs, but not all the authors were significantly improved for each construct.

Fifty percent of the authors (authors 2, 3, 4, 5, 7, 13, and 14) received post-training ratings that were lower than their pre-training ratings. The results from these seven authors are contrary to our hypotheses and indicate that their written communication skills got worse after the training session. Different authors had different levels of significance within their scores, which are discussed at length in Chapter 4. These seven authors all received lower ratings post-training than pre-training for all seven constructs, but not all the authors were significantly improved for each construct.

Hypothesis Testing and Theoretical Framework

It is most effective to consider the hypotheses and theoretical framework on an author by author basis rather than looking at the results as a whole. Ultimately, 50% of the authors supported the hypotheses and the theoretical framework presented in Chapter 2 and 50% of the authors showed results contrary to the hypotheses and theoretical framework. This doesn't necessarily mean that the hypotheses are rejected or the theoretical framework is incorrect, but asks us to consider the many factors at play within the authors themselves, which are discussed below.

Discussion of Author Improvement

The analysis of writing skills is a notoriously difficult subject. Sommers (2008) best describes this study's experience of analyzing writing skills:

> Writing development involves steps both forward and backward, gains and losses, and requires some amount of "bad" writing while new skills are practiced. These steps backward, which often defy our best attempts to describe progress, are often indicators that students are struggling to learn something new. It is not uncommon to see students regress in one area as they practice another. From a

> longitudinal perspective, writing development is neither linear or sequential, nor entirely predictable. (p. 154)

It becomes challenging to state why 50% of the authors in this study seemed to get worse after the training session rather than seeing their writing skills improve. Perhaps their first message was truly their best, and additional instruction on communication theory confused their message. It is possible some of the Academy participants had already received a different kind of science communication training, so adding additional instructions made their writing skills less clear or had no effect on their post-training message. There is also potential that participants were not fully engaged in the training session due to the time of day and the strenuous nature of the Academy sessions. This training session took place at the end of the day, meaning the Academy participants had already attended ten hours of training and information sessions. The use of MTurk could have influenced our results as well, and this concept is discussed at length below. Ultimately, it is beyond the scope of this study to clearly state why 50% of the authors failed to improve after the training session, but the researcher is encouraged by the results of 50% of the authors improving.

Another factor to consider is the results of Krippendorff's alpha for the constructs being tested. The alpha scores collected were extremely low, meaning this study's interrater reliability was almost nonexistent. This is one potential explanation for the wide range of results different authors received, as well as a possible explanation as to why some authors seemed to get worse rather than better.

Ultimately, these scores for interrater reliability point towards MTurk, the service used to recruit survey takers for this study. While other studies suggested MTurk was an effective method to collect survey takers for ELM research, as discussed in Chapter 2, this doesn't seem to be the case for this particular study. MTurk was effective in terms of collecting a large number of survey responses in a short period of time. It is possible MTurk was not effective for this study in particular because the survey was set up in a way that is different from most MTurk tasks. The proper completion of this study's survey expected MTurk raters to fully read and comprehend each individual paragraph, which is very different from the kind of surveys they are usually asked to complete. As stated in Chapter 2, the characteristics of the message recipient influence how the message is received and elaborated on. It appears the MTurk raters had characteristics that made elaboration difficult. Another potential flaw with MTurk is that some questions within the survey could be interpreted as the survey taker's opinion on the matter rather than an actual analysis of the author's writing and communication skills, creating a potential for bias.

Ultimately, this study concludes that the experimental design had potential for success and the use of a different set of raters could have potential to achieve better results. This survey required a large sample size to be able fully analyze the writing skills of the different authors. Asking fewer questions could be an effective method to decrease the sample size in order to recruit survey takers that are more highly qualified. It could be beneficial to select raters from a pool of communication experts or experts in the field that is being communicated about. However, that field of experts is much

smaller than the field of MTurk raters, again calling into question the balance between sample size, effect size, and qualified survey takers.

Limiting Factors

All research studies have limitations based on time and scope. This study recognizes that the messages created have certain limitations. The overarching limiting factor with studies that attempt to teach communication skills is the existing skills of the participants. This study recognizes that not all Academy participants have an equal level of communication skills before the training starts. Some messages will have more room to improve than others, but all messages created were tested in order to remove some of this bias. This study attempted to select topics that the Academy participants would be knowledgeable and comfortable writing about, but there are still different levels of knowledge and comfort within the participants.

This study also faced limitations within the individuals rating the message. Preferred populations for raters are discussed above. Ultimately, decisions were made to best reflect the size and scope of this study while still allowing the study to be completed within the required timeline.

Methodological Challenges and Recommendations for Future Studies

The first recommended adjustment to the methodology outlined in this study that future studies should consider is improving their population of raters. By following the recommendations discussed above, future studies have the opportunity to improve their interrater reliability and achieve results with stronger significance. Another potential improvement could include creating a training for the raters. Sample messages that

represent the constructs being tested could be used to calibrate the raters and prepare them to rate messages of different skill levels. Future researchers would have to determine who should write these sample messages and the best ways to represent the constructs of the ELM based on the literature.

Another recommendation from this study is to increase the randomization of the order of messages survey takers are shown. During this study, survey takers were shown two randomly selected pre-training messages, followed by two randomly selected post-messages. Improving the randomization to mix the pre-training and post-training messages could improve the clarity of the results by removing a layer of bias potential survey fatigue.

Adjustments could be made to the training session as well to include other factors of writing theory, as outlined by Sommers (2008). This includes making the training session more interactive and including opportunities for peer review and rewriting.

The ELM has different recommendations for communication via the central and peripheral routes. In practice, it is challenging to isolate one route rather than the other. This study recommends that future research focus on how to engage the central route in message recipients who are more likely to take the peripheral route, while also focusing on how to make attitude change more common and long-lasting when using the peripheral route.

Recommendations for Practice

First and foremost, this study recommends that science communicators take advantage of credible training opportunities that are available. Not all science

communication trainings are created equal, but looking for trainings that follow the constructs discussed throughout this study could be beneficial for science communicators. While it is challenging to address the writing skills of individual communicators, this researcher still suggests that some training is better than no training. By including elements of argument quality, source credibility, number of arguments, compelling messages, factual messages, relatable messages, and self-referencing, science communicators can better reach their target audience and influence attitudes and behavior towards science in the public's everyday life.

Conclusion

Ultimately, this study found that the ELM can be used as a method to teach science communication. However, communication is complex and science communication can have other challenges depending on subject matter. This researcher believes that credible science communication training is crucial for scientists and researchers, and the method of testing the model should be honed for future replications in order to best test the ELM.

The ELM framework and the training session created through this study can be used to train future Academy participants to better communicate messages about water in Nebraska. Science communication is an important skill for scientists and resource professionals to learn and implement, and integration of this training session into the Academy curriculum will support the mission of the Academy while giving participants practical tools for their daily work.

References

Arp, A. (2018). Using values to communicate agricultural science: An Elaboration Likelihood Model approach. Unpublished thesis, Iowa State University, Ames, IA. Retrieved from https://pdfs.semanticscholar.org/cef1/9dfcd3ee2bf5d5bff8bbf95918acae4641c5.pdf

Angst, C. M., & Agarwal, R. (2009). Adoption of electronic health records in the presence of privacy concerns: The Elaboration Likelihood Model and individual persuasion. *MIS Quarterly*, *33*(2), 339–370. Retrieved from https://www.jstor.org/stable/pdf/20650295.pdf

Bankston, A., & McDowell, G. S. (2018). Changing the culture of science communication training for junior scientists. *Journal of Microbiology and Biology Education, 19*(1). Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5969424/

Battacherjee, A., & Sanford, C. (2006). Influence processes for information technology acceptance: An elaboration likelihood model. *MIS Quarterly*, *30*(4), 805–825. Retrieved from https://www.jstor.org/stable/pdf/25148755.pdf

Brossard, D., Lewenstein, B., & Bonney, R. (2005). Scientific knowledge and attitude change: The impact of a citizen science project. *International Journal of Science Education*, *27*(9), 1099–1121. https://doi.org/10.1080/09500690500069483

Bruine De Bruin, W., & Bostrom, A. (2013). *Assessing what to address in science communication*. *Proceedings of the National Academy of Sciences, 110,* 14062-14068. https://doi.org/10.1073/pnas.1212729110

Burnkrant, R. E., & Unnava, H. R. (1995). Effects of self-referencing on persuasion. *Journal of Consumer Research*, *22*(1), 17–26. Retrieved from https://www.jstor.org/stable/pdf/2489697.pdf

Cacioppo, J. T., & Petty, R. E. (1984). The Elaboration Likelihood Model of persuasion. *ACR North American Advances*, *NA-11*. Retrieved from http://www.acrwebsite.org/search/view-conference-proceedings.aspx?Id=6329

De Swert, K. (2012). Calculating inter-coder reliability in media content analysis using Krippendorff's Alpha. *University of Amsterdam.* Retrieved from https://www.polcomm.org/wp-content/uploads/ICR01022012.pdf

Ford, G. T., Smith, D. B., & Swasy, J. L. (1990). Consumer skepticism of advertising claims: Testing hypotheses from economics of information. *Journal of Consumer Research*, *16*(4), 433–441. Retrieved from https://www.jstor.org/stable/pdf/2489454.pdf

Geddes, J. (2016). Elaboration Likelihood Model Theory – Using ELM to get inside the user's mind. Interaction Design Foundation. Retrieved July 29, 2019, from Interaction Design Foundation website: https://www.interaction-design.org/literature/article/elaboration-likelihood-model-theory-using-elm-to-get-inside-the-user-s-mind

Greenwald, A. G., & Leavitt, C. (1984). Audience involvement in advertising: Four levels. *Journal of Consumer Research*, *11*(1), 581–592. Retrieved from https://www.jstor.org/stable/pdf/2489145.pdf

Haugtvedt, C. P., & Petty, R. E. (1992). Personality and persuasion: need for cognition

moderates the persistence and resistance of attitude changes. *Journal of Personality and Social Psychology*, *63*(2), 308–319. Retrieved from https://s3.amazonaws.com/academia.edu.documents/41918761/Personality_and_Persuasion_Need_for_Cogn20160202-30232-12njgx2.pdf?response-content-disposition=inline%3B filename%3DPersonality_and_persuasion_Need_for_cogn.pdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X

Kim, A. K., Airey, D., & Szivas, E. (2010). The multiple assessment of interpretation effectiveness: Promoting visitors' environmental attitudes and behavior. *Journal of Travel Research*. *50*, 321-334. Retrieved from http://epubs.surrey.ac.uk/3019/2/2011_Aise_Kim_JTR_final.pdf

Kitchen, P. J., & Kerr, G. (2014). The elaboration likelihood model: Review, critique and research agenda *European Journal of Marketing*. *48,* 2033-2050. https://doi.org/10.1108/EJM-12-2011-0776

Kollmuss, A., & Agyeman, J. (2010). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239-260. Retrieved from https://www.tandfonline.com/doi/pdf/10.1080/13504620220145401

Lazard, A., & Atkinson, L. (2015). Putting environmental infographics center stage. *Science Communication*, *37*(1), 6–33. https://doi.org/10.1177/1075547014555997

Logan, R. (2001). Science mass communication: Its conceptual history. *Science Communication*, *23*(2), 135–163. Retrieved from

https://journals.sagepub.com/doi/pdf/10.1177/1075547001023002004?casa_token=NU7xUTmS690AAAAA%3AhkW5sBLPf9ru9rM_CD9v-a261nee6Ow7yvm2t0mO7LuQcIOIh366CnEg24VoDe4BC-YT_sc-3y2E

MacDonald, E., Milfont, T., & Gavin, M. (2016). Applying the Elaboration Likelihood Model to increase recall of conservation messages and elaboration by zoo visitors. *Journal of Sustainable Tourism*, *24*(6), 866–881. https://doi.org/10.1080/09669582.2015.10914

Marion, J. L., & Reid, S. E. (2007). Minimising visitor impacts to protected areas: The efficacy of low impact education programmes. *Journal of Sustainable Tourism*, *15*(1), 5–27. https://doi.org/10.2167/jost593.0

Mason, W., & Suri, S. (2012). Conducting behavioral research on Amazon's Mechanical Turk. *Behavior Research Methods*, *44*, 1–23. Retrieved from https://link.springer.com/content/pdf/10.3758%2Fs13428-011-0124-6.pdf

Meyers-Levy, J. (1991). Elaborating on elaboration: The distinction between relational and item-specific elaboration. *Journal of Consumer Research*, *18*, 358–367. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.927.3094&rep=rep1&type=pdf

Monto, G., & Malhotra, R. (2011). Conservation of biodiversity and its communication. *Current Science, 100*(3), 10.

Moore, D. L., Hausknecht, D., & Thamodaran, K. (1986). Time compression, response opportunity, and persuasion. *Journal of Consumer Research*, *13*(1), 85–99.

Retrieved from https://www.jstor.org/stable/pdf/2489288.pdf

Morris, J. D., Woo, C., & Singh, A. J. (2005). Elaboration likelihood model: a missing intrinsic emotional implication. *Journal of Targeting, Measurement and Analysis for Marketing*, *14*(1), 79–98. Retrieved from https://link.springer.com/content/pdf/10.1057/palgrave.jt.5740171.pdf

Nebraska State Irrigation Association. (2020). Nebraska Water Leaders Academy. Retrieved April 10, 2020, from https://waterleadersacademy.org/

Nisbet, M. C. & Mooney, C. (2007). Framing science. *Science, 316,* 56.

Nguyen, L. T., Hess, T. J., Liu, Y., & Sheffler, Z. (2019). *Trust in online reviews: Integrating the elaboration likelihood model and IS trust*. Proceedings of the Twenty-fifth Americas Conference on Information Systems, Cancun, Mexico, August 15-17, 2019, 1-5. Retrieved from https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1263&context=amcis2019

O'Keefe, D. J. (2013). *Elaboration Likelihood Model*. In the International Encyclopedia of Communication (Vol 4, pp. 1475-1480). Malden, MA: Blackwell Publishing. Retrieved from http://www.dokeefe.net/pub/okeefe08iec-elm.pdf

Paolacci, G., Chandler, J., Ipeirotis, P. G., & Stern, L. N. (2010). Running experiments on Amazon Mechanical Turk. In *Judgment and Decision Making* (Vol. 5).

Petty, R. E., Barden, J., & Wheeler, S. C. (2009). The Elaboration Likelihood Model of persuasion: Developing health promotions for sustained behavioral change. In R. J. DiClemente, R. A.,Crosby, & M. C. Kegler, (Eds.). *Emerging theories in health promotion practice and research* (pp. 185–214). San Francisco: Jossey-Bass.

Retrieved from https://psycnet.apa.org/record/2009-19878-007

Petty, R. E., Briñol, P., & Priester, J. R. (2009). Mass media attitude change: Implications on the Elaboration Likelihood Model of persuasion. In J. Bryant & Z. Zillmann, (Eds.). *Media effects: Advances in theory and research* (pp. 125–164). Mahwah, NJ: Taylor & Francis. Retrieved from https://www.researchgate.net/publication/209409946

Petty, R. E., & Cacioppo, J. T. (1981). *Attitudes and Persuasion: Classic and Contemporary Approaches*. New York: Taylor and Francis:.

Petty, R. E., & Cacioppo, J. T. (1986). The Elaboration Likelihood Model of persuasion. *Advances in Experimental social psychology*, *19*, 123-205. https://doi.org/10.1016/S0065-2601(08)60214-2

Petty, R. E., Cacioppo, J. T., & Goldman, R. (1981). Personal involvement as a determinant of argument-based persuasion. *Journal of Personality and Social Psychology, 41*, 847-855. Retrieved from https://pdfs.semanticscholar.org/0357/60d992c9f3afbd4398ac3431db62202bde1a.pdf

Petty, R. E., & Wegener, D. T. (1999). The Elaboration Likelihood Model: Current status and controversies. In S. Chaiken & Y. Trope, (Eds.), *Dual-process theories in social psychology* (pp. 37-72). New York: Guilford Press Retrieved from https://www.researchgate.net/publication/260673325_The_Elaboration_Likelihood_Model_Current_status_and_controversies

Priester, J., Wegener, D., Petty, R., & Fabrigar, L. (1999). Examining the psychological

process underlying the sleeper effect: the elaboration likelihood model explanation. *Media Psychology*, *1*(1), 27–48. Retrieved from https://www.marshall.usc.edu/sites/default/files/priester/intellcont/1999-MEDIA-PriesterWegenerPettyFabrigar-1.pdf

Puto, C. P., & Wells, W. D. (1984). Informational and transformational advertising: the differential effects of time. *ACR North American Advances*, *NA-11*. Retrieved from http://www.acrwebsite.org/volumes/6323/volumes/v11/NA-11

Rakedzon, T., Segev, E., Chapnik, N., Yosef, R., & Baram-Tsabari, A. (2017). Automatic jargon identifier for scientists engaging with the public and science communication educators. *PLOS ONE*, *12*(8), e0181742. https://doi.org/10.1371/journal.pone.0181742

Sharon, A. J., & Baram-Tsabari, A. (2014). Measuring mumbo jumbo: A preliminary quantification of the use of jargon in science communication. *Public Understanding of Science*, *23*(5), 528–546. https://doi.org/10.1177/0963662512469916

Sommers, N. (2008). The call of research: a longitudinal view of writing development. *College Composition and Communication, 60(1),* 152-164. Retrieved from https://www.jstor.org/stable/20457050

Sussman, S. W., & Siegal, W. S. (2003). Informational influence in organizations: An integrated approach to knowledge adoption. *Information Systems Research*, *14*(1), 47–65. Retrieved from https://pubsonline.informs.org/doi/pdf/10.1287/isre.14.1.47.14767

Wiggins, G. P., & McTighe, J. (2008). *Understanding by design*. *Chapter 2:*

Understanding Understanding. Alexandria, VA: Association for Supervision and Curriculum Development. doi: http://www.ascd.org/publications/books/103055/chapters/Understanding-Understanding.aspx

Winter, S., & Kramer, N. C. (2012). Selecting science information in Web 2.0: How source cues, message sidedness, and need for cognition influence users' exposure to blog posts. *Journal of Computer-Mediated Communication*, *18*, 80–96. Retrieved from https://watermark.silverchair.com/jjcmcom0080.pdf?token=AQECAHi208BE49Ooan9kkhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAAApEwggKNBgkqhkiG9w0BBwagggJ-MIICegIBADCCAnMGCSqGSIb3DQEHATAeBglghkgBZQMEAS4wEQQMhzHJlfPZ2drl8IZBAgEQgIICRIneJ2c8OFdChw3x2Ytui8lWOFgjthKQ7zToI7ODP_g

Appendix A – Krippendorff's Alpha

	Pre-training	Post-training
Argument Quality Q1	0.0367	0.2258
Argument Quality Q2	0.0422	0.1769
Argument Quality Q3	0.0354	0.1875
Argument Quality Q4	0.0475	0.1597
Source Credibility Q1	0.0256	0.1896
Source Credibility Q2	0.0115	0.1177
Source Credibility Q3	0.0187	0.1610
Number of Arguments Q1	0.0529	0.1945
Compelling Argument Q1	0.040	0.1434
Compelling Argument Q2	0.0382	0.1552
Compelling Argument Q3	0.0368	0.1334
Factual Message Q1	0.0155	0.0940
Factual Message Q2	0.0191	0.1155
Factual Message Q3	0.0174	0.1144
Relatable Message Q1	0.0219	0.0735
Relatable Message Q2	0.0219	0.0505
Relatable Message Q3	0.0142	0.0528
Self-Referencing Q1	0.0145	0.0410
Self-Referencing Q2	0.0067	0.0560

Appendix B – Informed Consent Letter

We are conducting research to determine effective methods of communicating science to the public. Please read the following consent form. By clicking yes, you agree to allow us to use your answers in our research.

IRB #: 19970
Formal Study Title: Using the Elaboration Likelihood Model to Evaluate Science Communication

Authorized Study Personnel
Principal Investigator: Ann Briggs Office: (402) 472-5355
Secondary Investigator: Mark Burbach, Ph.D. Office (402) 472-8210

Key Information:
If you agree to participate in this study, the project will involve:
· Males and females over the age of majority. In Nebraska and Alabama, participants must be 19 years of age or older. In Mississippi, participants must be 21 years of age or older. In all other states, participants must be 18 years of age or older.
· Procedures will include reading four paragraphs and assessing the quality of the persuasive communication
· There are no known risks associated with this study
· You will be paid $1.00 for your participation
· You can print a copy of this consent form for your records

Invitation
You are invited to take part in this research study. The information in this form is meant to help you decide whether or not to participate.

Why are you being asked to be in this research study?
You are being asked to be in this study because you are an MTurk worker who lives in the United States and reads English. You must be the age of majority in your state to participate.

What is the reason for doing this research study?
The purpose of this study is to test a method of improving written science communication. The messages analyzed in this study come from scientists, researchers, and resource professionals and were written to address a question from the general public.

What will be done during this research study?
You will be asked to read four messages and rate the quality of the persuasive communication. This survey is expected to take 20 minutes to complete and you may complete it from your personal computer or mobile phone.

How will my data be used?
The findings of this study will be published in a scientific journal. Sometimes when studies are published, the researchers are asked to release data to make sure that data was analyzed correctly. If we are asked to do this, any personal information that could identify you will be removed before the data is shared.

What are the possible risks of being in this research study?
There are no known risks to you from being in this research study.

What are the possible benefits to you?
You are not expected to get any benefit from being in this study.

What are the possible benefits to other people?
The benefits to science and/or society may include a better understanding of the communication process between scientists and the general public, allowing scientists to improve their communication in the future.

What will being in this research study cost you?
There is no cost to you to be in this research study.
Will you be compensated for being in this research study?
You will receive $1.00 for your participation in this study.
What should you do if you have a problem during this research study?
Your welfare is the major concern of every member of the research team. If you have a problem as a direct result of being in this study, you should immediately contact one of the people listed at the beginning of this consent form.
How will information about you be protected?
This study will involve the collection of private information (name, dates, etc.). Your information could be used or distributed to another researcher for future studies without an additional informed consent from you. Identifiers (names, dates, etc.) will be removed prior to being distributed. Reasonable steps will be taken to protect your privacy and the confidentiality of your study data. The data will not be identifiable to you and will be stored electronically through a secure server and will only be seen by the research team during the study. The only persons who will have access to your research records are the study personnel, the Institutional Review Board (IRB), and any other person, agency, or sponsor as required by law. The information from this study may be published in scientific journals or presented at scientific meetings but the data will be reported as group or summarized data and your identity will be kept strictly confidential.
What are your rights as a research subject?
You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study.

For study-related questions, please contact the investigator(s) listed at the beginning of this form.
For questions concerning your rights or complaints about the research contact the Institutional Review Board (IRB):
· Phone: 1(402)472-6965
· Email: irb@unl.edu

What will happen if you decide not to be in this research study or decide to stop participating once you start?

You can decide not to be in this research study, or you can stop being in this research study ("withdraw') at any time before, during, or after the research begins for any reason. Deciding not to be in this research study or deciding to withdraw will not affect your relationship with the investigator or with the University of Nebraska-Lincoln (list others as applicable).
You will not lose any benefits to which you are entitled.

Documentation of informed consent

You are voluntarily making a decision whether or not to be in this research study. Clicking the button below means that you have read and understood this consent form and you have decided to be in the research study.

Appendix C – Questionnaire

Thank you for participating in our survey! Before we begin, we would like you to complete the following assessment of pre-existing values on environmental issues.

Assessment of pre-existing values on environmental issues using the following scale

No Support **Fully Support**

1 **2** **3** **4**

Building new infrastructure for urban flood management.

Voluntary urban water conservation practices.

Taking action to reduce water pollution from industrial sites.

Taking action to address groundwater quality as a result of agricultural practices.

Practices that increase stream flow.

Using sustainable transportation (public transportation, carpooling, biking).

Buying locally produced products and food.

Recycling household materials and using less plastic.

Buying ethically made clothing.

Switching to renewable energy sources.

The following hypothetical email was sent by a concerned citizen in a community facing (insert challenge here, unique for each question).

To whom it may concern.

I recently saw on the news that our community is (building new infrastructure for urban flood management, taking action to address groundwater quality as a result of agricultural practices, or taking action to increase stream flow). This is an issue I know little about and was wondering if you could explain why this problem is important and why our community will be addressing it?

This hypothetical email was answered in the following paragraph by a member of a water leader's training academy through a session on science communication. Please read the following paragraph and answer the questions below.

Argument Quality:

AQl. How informative was the information provided?

Not at all informative	**Somewhat informative**	**Informative**	**Very informative**
1	**2**	**3**	**4**

AQ2. How helpful was the information provided?

Not at all helpful	**Somewhat helpful**	**Helpful**	**Very helpful**
1	**2**	**3**	**4**

AQ3. How valuable was the information provided?

Not at all valuable	**Somewhat valuable**	**Valuable**	**Very valuable**
1	**2**	**3**	**4**

AQ4. How persuasive was the information provided?

Not at all persuasive	**Somewhat persuasive**	**Persuasive**	**Very Persuasive**
1	**2**	**3**	**4**

Source Credibility:

SC 1. How knowledgeable does the person writing the argument appear?

Not at all knowledgeable	**Somewhat knowledgeable**	**Knowledgeable**	**Very Knowledgeable**
1	**2**	**3**	**4**

SC2. How trustworthy does the person writing the argument appear?

Not at all trustworthy	**Somewhat trustworthy**	**Trustworthy**	**Very trustworthy**
1	**2**	**3**	**4**

SC3. How credible does the person writing the argument appear?

Not at all credible	**Somewhat credible**	**Credible**	**Very credible**
1	**2**	**3**	**4**

SC4. How much of an expert does the person writing the argument appear?

Not at all expert	**Somewhat expert**	**Expert**	**Very expert**
1	**2**	**3**	**4**

Factual Message

FM1. To the best of your knowledge, how accurate is the information presented?

Not at all accurate	**Somewhat accurate**	**Accurate**	**Very accurate**
1	**2**	**3**	**4**

FM2. To the best of your knowledge, how credible is the information presented?

Not at all credible	**Somewhat credible**	**Credible**	**Very credible**
1	**2**	**3**	**4**

FM3. To the best of your knowledge, how valid is the information presented?

Not at all valid	**Somewhat valid**	**Valid**	**Very valid**
1	**2**	**3**	**4**

Relatable Message

RM1. How relatable is the information presented in the message?

Not at all relatable	**Somewhat relatable**	**Relatable**	**Very relatable**
1	**2**	**3**	**4**

RM2. How much do you personally identify with the information contained in the message?

Not at all identify	Somewhat identify	Identify	Strongly identify
1	**2**	**3**	**4**

RM3. How much do you personally connect with the ideas conveyed in the message?

Not at all connected	Somewhat connected	Connected	Very connected
1	**2**	**3**	**4**

Self Referencing

SR1. How much did this message make you reflect on yourself and your experiences?

Not at all reflective	Somewhat reflective	Reflective	Very reflective
1	**2**	**3**	**4**

SR2. How much did this message make you reflect on your own community?

Not at all reflective	Somewhat reflective	Reflective	Very reflective
1	**2**	**3**	**4**

Compelling Argument

CA1. How compelling was the information provided?

Not at all compelling	Somewhat compelling	Compelling	Very compelling
1	**2**	**3**	**4**

CA2. How convincing was the information provided?

Not at all convincing	Somewhat convincing	Convincing	Very convincing
1	**2**	**3**	**4**

CA3. How engaging was the information provided?

Not at all engaging	Somewhat engaging	Engaging	Very engaging

1 2 3 4

Use the following scale:

Low High

1 2 3 4

Number of arguments included in the message

Appendix D – IRB Approval Letter

University of Nebraska Lincoln

Official Approval Letter for IRB project #19970 - New Project Form

December 20, 2019

Ann Briggs
School of Natural Resources
HARH 244 north UNL NE 685830921

Mark Burbach
School of Natural Resources
HARH 623 south UNL NE 685830996

IRB Number: 20191219970EX
Project ID: 19970
Project Title: Using the Elaboration Likelihood Model to Evaluate Science Communication

Dear Ann:

This letter is to officially notify you of the certification of exemption of your project for the Protection of Human Subjects. Your proposal is in compliance with this institution's Federal Wide Assurance 00002258 and the DHHS Regulations for the Protection of Human Subjects at 45 CFR 46 2018 Requirements and has been classified as exempt. Exempt categories are listed within HRPP Policy #4.001: Exempt Research available at:
http://research.unl.edu/researchcompliance/policies-procedures/.

o Date of Final Exemption: 12/20/2019
o Review conducted using exempt category 2a at 45 CFR 46.104
o Funding (Grant congruency, OSP Project/Form ID and Funding Sponsor Award Number, if applicable): Prime: Nebraska Environmental Trust through Nebraska State Irrigation Association; OSP Project ID 45889, Form ID 131265; Grant Congruency Review Conducted 12/20/2019

We wish to remind you that the principal investigator is responsible for reporting to this Board any of the following events within 48 hours of the event:
* Any serious event (including on-site and off-site adverse events, injuries, side effects, deaths, or other problems) which in the opinion of the local investigator was unanticipated, involved risk to subjects or others, and was possibly related to the research procedures;
* Any serious accidental or unintentional change to the IRB-approved protocol that involves risk or has the potential to recur;
* Any protocol violation or protocol deviation
* An incarceration of a research participant in a protocol that was not approved to include prisoners
* Any knowledge of adverse audits or enforcement actions required by Sponsors
* Any publication in the literature, safety monitoring report, interim result or other finding that indicates an unexpected change to the risk/benefit ratio of the research;
* Any breach in confidentiality or compromise in data privacy related to the subject or others; or
* Any complaint of a subject that indicates an unanticipated risk or that cannot be resolved by the research staff.

This project should be conducted in full accordance with all applicable sections of the IRB Guidelines and you should notify the IRB immediately of any proposed changes that may affect the exempt status of your research project. You should report any unanticipated problems involving risks to the participants or others to the Board.

If you have any questions, please contact the IRB office at 402-472-6965.

Sincerely,

Becky R. Freeman

Becky R. Freeman, CIP
for the IRB

Full Accreditation

Appendix E - Training Session Notes

Communicating Science to the Public

Ann Briggs

Write a message to the public

- 15 minutes to respond to the prompt
- Scenario: a member of the public has emailed you to inquire about a current project/problem in the community

Why practice science communication?

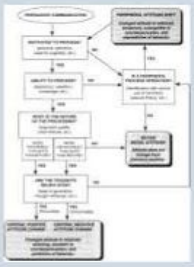
- Importance of communicating effectively with the public
- Prior experience
- Questions and concerns

Elaboration Likelihood Model

- Introduced by Petty and Cacioppo in 1981
- Theory developed to address irregularities and questions in attitude and behavior change research in the 1960's and 1970's.
- The ELM "Provides a fairly general framework for organizing, categorizing, and understanding the basic processes underlying the effectiveness of persuasive communications"
- Elaboration is a continuum
  - Low elaboration: message recipients do not analyze the message
  - High elaboration: message recipients analyze the message and integrate it into their attitudes

Elaboration Likelihood Model

- Two routes to persuasion
- Central route
  - Coincides with high elaboration in message recipients
  - Central route is more likely to cause long-term attitude changes
  - Recipient uses prior experience and knowledge to evaluate the arguments in the message
- Peripheral route
  - Coincides with low elaboration
  - Message has little to no relevance to recipient or the recipient is unable to process the message
  - Attitude changes are less enduring



Factors that improve communication

- Argument quality
- Source credibility
- Number of arguments
- Compelling arguments
- Factual message
- Relatable message
- Self referencing

Argument Quality

- Improving argument quality will lead to improved persuasive communication
- What is argument quality?
  - The persuasive strength of arguments embedded in an information message
- How do we improve argument quality?
  - Include information that is informative, helpful, and valuable to the message recipient
  - Arguments within the message should be complete, consistent, and accurate

Source Credibility

- Source credibility positively influences perceived usefulness of information
- What is source credibility?
  - The extent to which an information source is perceived to be believable, competent, and trustworthy by information recipients
- How do we improve source credibility?
  - Consider author of the message (yourself) and the source of the information you're sharing
  - Knowledgeable, trustworthy, credible
  - Expert opinion

Number of Arguments

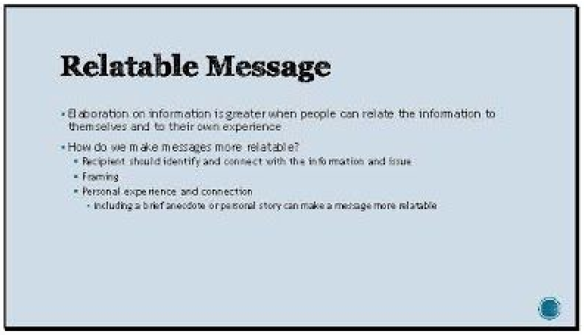
- Low involvement
  - Recipients agreed with messages more when more arguments were presented
- High involvement
  - Little impact on the persuasiveness of the message
- How do we improve number of arguments?
  - For the most part, increasing the number of arguments in the message while following the other guidelines will make your message more persuasive

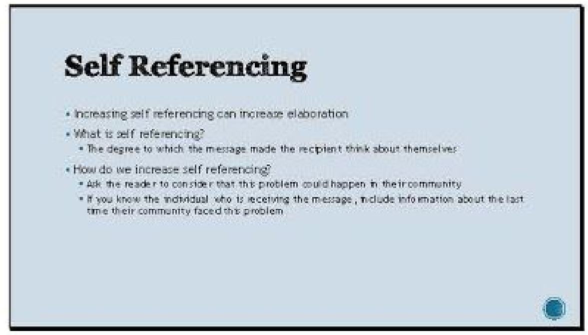
Compelling Arguments

- High involvement
  - More arguments led to more persuasion when the arguments were compelling
- Low involvement
  - Little impact on the persuasiveness of the message
- How do we make arguments more compelling?
  - Include messages that are convincing and engaging
  - Including a 'call to action' can make an argument compelling

Factual Message

- Factual messages are more believable and more persuasive, particularly for high involvement recipients
- How do we make messages more factual?
  - Include information that is accurate, credible, and valid
  - Include statistics and specific values related to the topic
    - Too many statistics can be overwhelming to the general public
    - Focus on statistics that are necessary to understand the problem and put the issue into perspective


Relatable Message
Elaboration on information is greater when people can relate the information to themselves and to their own experience
How do we make messages more relatable?
Recipient should identify and connect with the information and issue
Framing
Personal experience and connection
Including a brief anecdote or personal story can make a message more relatable


Self Referencing
Increasing self referencing can increase elaboration
What is self referencing?
The degree to which the message made the recipient think about themselves
How do we increase self referencing?
Ask the reader to consider that this problem could happen in their community
If you know the individual who is receiving the message, include information about the last time their community faced this problem


Write a message to the public
15 minutes to respond to the prompt
Scenario: a member of the public has emailed you to inquire about a current project/problem in the community
Consider ELM factors
Argument quality
Source credibility
Number of arguments
Compelling arguments
Factual message
Relatable message
Self referencing
Discussion to follow


Wrap Up
What was the most useful tool you learned in this session?
Is this kind of training that would be useful in your workplace?
How will you implement these communication tools in your daily work?
Discuss with a partner


References