The Communication Preferences and Science Communicator Identities of University of Idaho Extension Faculty and Educators

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Klae D. O'Brien

Major Professor: Sarah A. Bush, Ph.D.

Committee Members: Kattlyn J. Wolf, Ph.D. & Maggie Elliot, M.S.

Department Administrator: James J. Connors, Ph.D.

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Authorization to Submit Thesis

This thesis of Klae D. O'Brien, submitted for the degree of Master's of Science with a Major in Agricultural Education and titled "The Communication Preferences and Science Communicator Identities of University of Idaho Extension Faculty and Educators" has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

Major Professor: _____ Date:_____
Sarah A. Bush, Ph.D.

Committee Members: _____ Date: _____
Kattlyn J. Wolf, Ph.D.

_____ Date: _____
Maggie Elliot, M.S.

Department
Administrator: _____ Date: _____
James J. Connors, Ph.D.

Abstract

This study explored what relationship existed between UI Extension educators and faculty's social identity as science communicators and the communication types they most commonly used. The findings from this study can help UI Extension, and the Cooperative Extension Service increase their communication and programming impact to new and changing audiences through specifically tailored research-based information that is disseminated effectively. This non-experimental, sequential, mixed-method study with a qualitative priority utilized surveys and interviews to gather data. The data found in the surveys described how UI Extension educators and faculty communicate with constituents. Data were analyzed using descriptive statistics, paired t-tests, and Wilcoxon-Signed Ranks tests. UI Extension educators and faculty's most preferred communication channels were walk-in, phone calls, and emails. Their constituents preferred walk-in, email, and phone calls. There was significant increase in time spent communicating during COVID as compared to before, and the utilization of mass communication also significantly increased. Interviews were used to understand their social identities as science communicators. Participants were selected for interviews through stratified purposive sampling based upon their location, urban or rural county, and communication type most commonly used. Interviews were recorded, transcribed verbatim, broken into meaning units, and open coded. Five main themes were identified: Continual development, technology, research dissemination, evaluation and motivation, and community relationships. These two sets of information were then mixed using cross case comparison to find significant relationships. This study found a significant relationship between an individual's most commonly used communication type and their social identity as science communicators.

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Dedication

This thesis is dedicated to my family members, friends, and loved ones. Thank you for being so patient during this hectic and stressful time. I am grateful for your unconditional support, understanding, and guidance in my life and this specific time. Thank you for always being willing to answer your phones and distract me from the chaos that was happening, and letting me fill your ears with complaints, interesting findings, random tangents, and the occasional stress breakdown. I truly could not have done this without you all.

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Chapter 1: Introduction

The Cooperative Extension Service (CES), established in 1914, was designed to communicate and share research-based information to the public (Ray et al., 2015; Seevers & Graham, 2012). CES provides a channel where reliable, research-backed information from land-grant universities is communicated to surrounding people, communities, and businesses. The mission of CES is "continued world leadership in agriculture and the stewardship of the nation's natural resources, to create confident, public-service oriented citizens through 4-H youth development and adult leadership programs and strengthen families and viability of communities" (Seevers & Graham, 2012, p. 12).

Although it was designed to communicate with the public, CES has been referred to as the "best kept secret" and therefore needs to be promoted to remain relevant (Ray et al., 2015). Fundamentally, CES and its programs were founded for rural and agriculturally-based individuals and their needs. However, there are fewer people living in rural communities and involved in food production than ever before; only 17% of the population now lives in a rural area (National Institute of Food and Agriculture, n.d.). In 2019, 10.9% of those employed in the U.S. were in the agriculture and related food sectors, which accounted for approximately 22.2 million jobs (Economic Research Service [ERS], 2020). Employment on farms accounted for 19.6 million jobs and 1.3% of U.S. employment (ERS, 2020). This can pose a problem to the communication strategies in urban-based extension programs because the foundation of communication within CES might differ from the needs and communication norms in urban areas (Webster & Ingram, 2007). CES has had to broaden and adapt programming to encompass an increasingly urban audience. To ensure the longevity of CES

and that it is able to carry out its mission, it needs to be well publicized and utilized by the public (Ray et al., 2015).

Extension professionals act as communicators and liaisons of reliable, research-backed information and help to assist in keeping the cyclical nature of communication (Kurtzo et al., 2019). These individuals must rely on new media channels and social trends to determine how to broadcast their messages widely to all constituents. Extension professionals utilize many communication channels to send messages to their constituents including electronic sources, face-to-face, phone calls, print, and broadcast (Kurtzo et al., 2019). Furthermore, extension professionals have indicated that understanding how to communicate effectively is an important aspect of their job (McDowell & Mizuno, 1987). This specifically includes listening to constituents and reciprocating effective communication based on the audience and their needs (McDowell & Mizuno, 1987). For example, age and gender have shown to have an impact on communication medium and channel preferences (Lamm et al., 2019). Understanding constituents needs, characteristics, and demographics can help an extension professional tailor their communication efforts specifically and increase the likelihood of understanding and acceptance (Agunda, 1998).

University of Idaho (UI) Extension is composed of 45 offices in 42 counties, with personnel covering all 44 counties and three Native American tribes (University of Idaho, n.d.). UI's land-grant purpose is,

> To deliver knowledge created at the University of Idaho to the people of Idaho for their beneficial use; to address national priorities; and to help guide the university's academic and research functions by keeping the university informed of the people's issues and problems" (University of Idaho Extension, n.d., p. 5).

The extension system in Idaho aims to provide information that is useful and beneficial for local communities. Individuals who work in extension act as liaisons of information by receiving and sending new information from universities to the local community (Kurtzo et al., 2019). Project areas within UI CES encompass agriculture, community development, family and consumer sciences, natural resources, and youth development. The goal of these programs and UI CES is to improve people's lives through research-based education (University of Idaho Extension, n.d.).

Idaho's population increased by 2.12% in 2020 and had the fastest growing population in the U.S. (Davis, 2020). This growing population has led to an increase of those living in urban areas and a decrease in the rural population. In 2019, 1.2 million people were living in urban areas, while 578,000 lived in rural Idaho (United States Department of Agriculture [USDA], 2021). Six Idaho counties are classified as urban and account for over 75% of the population – Ada, Canyon, Kootenai, Bonneville, Bannock, and Twin Falls (Idaho Department of Labor, 2017). Extension professionals have developed new goals and projects to cater to the more urbanized and diverse audience, while continuing traditional programming benefiting rural communities and agricultural communities (University of Idaho Strategic Plan, n.d.). UI Extension has projects that target Idaho's rural audience, including various commodity production, farm and ranch management, land and livestock, etc. (University of Idaho, n.d.). Program areas and projects have also expanded to appeal to a more urban audience, including gardening, nutrition, and small farms (University of Idaho, n.d.). With this shift in constituents, online communication and social media presence have become important for UI Extension, alongside maintaining traditional in-person communication (University of Idaho Extension, 2018).

Statement of Problem

Changing audiences and funding problems continue to pose a challenge for CES. In order to ensure the longevity and effectiveness of research-based information that stems from CES, extension professionals need effective communication methods and styles for their new and changing audiences. Understanding the audience and proactively framing information for the audience is important to increase buy in from constituents (Jenkins et al., 2020). An individual who identifies as a science communicator is more likely to actively take part in action to increase the quality and personalization of their communication (Baram-Tsabari & Lewenstein, 2017). Successfully understanding how to frame and diffuse information within a community can help to keep CES well known and utilized by a larger audience.

Purpose

The purpose of this research is to explore how UI Extension faculty and educators identify as science communicators and what impact their identities have on the communication types and channels they utilize. This study will provide CES with insight into how an individual's science communication identity relates to the types of communication they most commonly use, and how they frame communication items to transfer information more effectively to constituents. The research questions that guided this study were:

Research Question 1: What communication types and channels are used by UI Extension faculty and educators to communicate with constituents?

Research Question 2: How do UI Extension faculty and educators describe their social identities as science communicators?

Research Question 3: What is the relationship between social identity as a science communicator and the communication types and channels used by UI Extension faculty and educators?

Theoretical Framework Overview

Social identity, diffusion of innovation, and framing provide the theoretical foundation for this study. An individual's social identity as a communicator can impact how they communicate with their constituents (Baram-Tsabari & Lewenstein, 2017). Someone who aligns themselves as a communicator will act in ways that increase their communication abilities, including framing messages and designing programs specifically for the target audience as well as exposing the audience to new innovations and information.

An individual's sense of belonging to a group that has shared values and norms influences their behavior and personal identity according to social identity theory (Stets & Burke, 2000). This theory examines the similarities between the individual and group and encompasses "all the attitudes, beliefs and values, affective reactions, behavioral norms, styles of speech, and other properties" (Stets & Burke, 2000, p. 225). Someone who associates themselves as a part of a group is more likely to behave in ways that align with those norms and values (Tajfel, 1974). Therefore, an extension professional's alignment with others and their goals as communicators should impact how they go about utilizing communication styles and channels when communicating with constituents.

Longnecker's (2016) integrated model of science communication presents the components and factors associated with effective science communication. This model is made up of internal and external factors that have an impact on science communication (Longnecker, 2016). An individual's identity is a key component of science communication

and is made up of eight factors that influence one's identity: affect, understanding, skills, awareness, behavior, attitudes, beliefs, and values (Longnecker, 2016). This model represents the components that work together to influence one's identity and how they communicate scientific information with others.

Diffusion of innovation theory describes the process through which new innovations get diffused through a social system and are subsequently accepted or rejected (Rogers, 2003). Diffusion of innovation theory can be initiated by the presentation of research-based information from extension professionals or opinion leaders. According to Rogers (2003), an opinion leader is someone who can influence others to believe or behave a certain way. Extension professionals can act as opinion leaders in their communities and have influence on constituent's decision to accept or reject new information presented to them (Rogers, 2003). Those who understand their roles as communicators and opinion leaders can utilize the innovation-decision process to effectively communicate information about current research and new innovations (Rogers, 2003).

The concepts of framing theory can help to increase the effectiveness of an extension professional's communication (Dameen et al., 2001). Framing theory postulates messages that are specifically designed for a target audience are more easily understood and accepted (Robinson, 2013). Extension professionals who understand and utilize the concepts of framing theory can modify their messages and programming to fit their constituents. This tailored approach can help increase the understanding of information and will lay a better foundation for the information to be utilized (Robinson, 2013). Utilizing the concepts of framing theory, social identity theory, and diffusion of innovation theories together can allow

information to be specifically tailored for the target audience and effectively presented to increase the likelihood of it being accepted.

Significance of the Study

Despite urbanization and CES changing from its original rural-based model, extension continues to prove itself to be adaptable and well utilized by the public. Extension continues to be viewed as trustworthy and viewed as "unbiased, objective, research-based, and credible" (Henning et al., 2014, p. 8). In 2019, UI Extension professionals recorded over 440,000 face-to-face interactions and over 830,000 web page views (University of Idaho, 2019). Restrictions from the ongoing COVID-19 pandemic forced UI Extension to be adaptable and demonstrate their dedication to helping communities and individuals. Through the end of 2019 and into 2020, UI Extension has increased free online programming and resources (University of Idaho, 2019). It is vital for UI Extension to maintain this flexibility and adaptability, as well as incorporating programming for new and diversifying audiences to meet new challenges.

However, extension is encountering new problems in the 21st century as the U.S. is becoming increasingly urbanized (Webster & Ingram, 2007). CES was founded on rural and agriculturally-based values and needs; rural audiences are the traditional audiences of CES. However, there are fewer people living in rural communities and involved in food production than ever before (ERS, 2021). In 1980, Idaho had a population of less than one million with 532,056 individuals living in urban areas (ERS, 2021). In 2019, Idaho's population increased to 1.78 million, with 1.2 million individuals living in urban areas (ERS, 2021). This can cause a disconnect between the communication strategies traditionally used and those best for urban-based extension programs (Webster & Ingram, 2007).

The economic impact of the COVID-19 global pandemic and budget cuts in recent years continue to be a threat to the future of extension. In 2018, UI CES received over $28 million in funding from the federal, state, and county levels as well as grants (University of Idaho, 2018). This funding directly benefits Idaho's communities and agricultural producers. To continue ensuring this funding, extension needs to continually assess communication methods and evolve to help deter funding cuts and increase recognition on many levels (Ray et al., 2015). It is important for UI Extension to stay relevant and the information flowing efficiently to receivers to ensure the longevity of CES in Idaho.

In order to reach new and changing demographics, "extension must adapt its very successful rural model to meet the challenges of the urban, poorer, and more ethnically diverse audience" (Henning et al., 2014, p. 2). Extension must continue to show its importance and impact for local communities by serving all demographics in their communities (Henning et al., 2014). Recognizing this gap in audience and programming and proactively working to deter it can have a positive impact on extension programs.

According to social identity theory, an individual who identifies with a group is more likely to participate in group culture, have greater commitment to the group, and behave like others in the group (Stets & Burke, 2000). Therefore, an extension professional's commitment to utilizing effective and updated communication types and learning new channels when necessary is impacted by their identification as a communicator (Stets & Burke, 2000). Understanding how an extension professional identifies as a science communicator and what relationship that has with the communication types they most often use can indicate their dedication to continually evolving their communication skills to meet the needs of their changing audiences.

Definition of Terms

Audience: The specific individual or group of people who are the target of the communication or message (Telg & Irani, 2012).

Communication Channel: The means through which a message is sent to an audience, e.g. electronic, print, air, radio waves (Telg & Irani, 2012).

Communication Types: The level at which the communication takes place: individual, group, and mass (Seevers & Graham, 2012).

Cooperative Extension Service (CES): A public and cooperatively funded education system that provides the public with research-based information from the United States Department of Agriculture (USDA), land-grant universities, and experiment stations (Seevers & Graham, 2012).

Extension Faculty and Educators: In the state of Idaho, these individuals working within Extension have obtained at least a masters or doctorate degree.

Extension Professional: An individual who works as an administrator, program specialist, county agent or educator, paraprofessional, or program assistant within the land-grant university and CES (Seevers & Graham, 2012).

Rural: Areas outside of the defined urban areas, and all remaining counties that are not part of core urban areas (ERS, 2019).

Science Communication: "The use of appropriate skills, media, activities, and dialogue to produce one or more of the following personal responses to science: awareness including familiarity with new aspects of science, enjoyment or other affective responses, interest as evidenced by voluntary involvement with science or its communication, opinions, the

forming, reforming or confirming of science related attitudes, and understanding of science, its content, processes, and social factors" (Burns et al., 2003, p. 191).

Social Identity: An individual's self-concept derived from his/her knowledge of their membership of a group(s), with emotional significance attached to that membership (Tajfel, 1974).

Urban: Areas that include "central countries with one or more urbanized area: urbanized areas are densely-settled urban entities with 50,000 or more people" or "outlying counties that are economically tied to the core countries as measured by labor-force commuting" (ERS, 2019).

Overview of Design

This study utilized a sequential, mixed methods design with a qualitative priority. In this study, surveys and interviews were used to collect data from extension faculty and educators in the state of Idaho. These individuals have obtained at least a master's degree or doctorate degree and are working in one of the four UI Extension districts or at one of the nine research and experiment stations. Qualified individuals received the link to the confidential Qualtrics survey via email. The survey was used to understand how UI Extension educators and faculty currently communicate with constituents and how that varied from communication prior to COVID-19 regulations. Demographic questions were also included. Data were analyzed using descriptive statistics. Respondents were asked to provide their contact information if they were willing to take part in the follow up interview portion of the study.

Participants were stratified into categories based upon district, county classification as urban or rural, and the communication type they used most often. After stratification,

individuals were purposively selected to take part in interviews. Sixteen total UI Extension faculty and educators were selected for Zoom interviews. Four individuals were unable to be reached. Therefore, a total of 12 interviews were conducted. There were three interview participants from the northern district, two from the central district, three from the eastern district, and four from the southern district. There were six participants from rural counties and six from urban counties. The interview protocol was adapted from Parrella and Leggette's (2020) interview protocol, which was based on Longnecker's (2016) integrated model of science communication. The semi-structured interviews took place via Zoom and were video recorded. Interviews were transcribed verbatim and then coded using preset codes based upon Longnecker's (2016) integrated model of science communication for common themes. Member checking was also utilized. Descriptive statistics, t-tests, and Wilcoxon Signed-Rank tests were used to describe the data from the surveys. Interviews were open coded for common themes. The quantitative and qualitative data were then mixed to analyze the relationships between the usage of communication types and perceived science communicator identity.

Limitations of Study

This study was designed to include 16 UI Extension faculty and educators, however, it ended up only including 12. The number of participants is enough to provide a glimpse into the intermingling of communication. This number of participants was determined to be sufficient because saturation in responses was reached. There might not be enough cohesive data for this study to be broadcast onto a larger population. The use of self-reported and lack of longitudinal data act as limitations in this study. The ongoing COVID-19 pandemic has

impacted how extension professionals are communicating and how programs are being delivered. Answers and attitudes from these individuals might be skewed due to this.

Reflexivity Statement

Assessing and acknowledging one's assumptions, beliefs, and biases can help to provide validity in qualitative research (Creswell & Miller, 2000). These preconceived beliefs might have an impact on interpretation of the research information. Acknowledging and stating this information allows the readers to understand the researcher's position (Creswell & Miller, 2000). The researcher also has an opportunity to understand their biases at the beginning of the research process and can work against the biases as the research continues (Creswell & Miller, 2000). Therefore, the following reflexivity statement has been prepared:

> I am a Caucasian female who was raised in a middle-class family. I have a bachelor's degree in Agricultural Science, Communication, and Leadership with a minor in Public Relations. My emphasis in communication courses in my undergraduate degree has helped develop my personal philosophy of the importance and need for communication in research areas. My experience with UI CES and knowledge of its programming are positive due to many positive interactions and experiences. I was a member of 4-H in Idaho for many years; and have interned with UI Extension and worked as a judge for multiple 4-H competitions and projects. I also plan on working within the UI Cooperative Extension System upon graduation.

Research Assumptions

There were several assumptions made in this study. It is assumed that the participants in this study are qualified representatives of UI Cooperative Extension. It is also assumed

that all participants answered survey and interview questions honestly and thoroughly without influence from others.

Summary

This mixed methods study aimed to understand what relationship exists between UI Extension educators and faculty's preferred communication type and how they view themselves as science communicators. Understanding the relationship can help to increase effective communication between extension and constituents. This can help to impact the visibility and utilization of extension by the public.

Chapter 2: Review of the Literature

The purpose of this study was to determine how University of Idaho Extension educators and faculty identify as science communicators and the relationship between their identities and the communication types and channels they utilize. The theoretical framework for this study was built upon social identity theory, framing theory, and diffusion of innovation theory. These theories guided the research to consider how an extension faculty or educator can effectively communicate with their audience by aligning with communicator norms, tailoring their messages, and acting as an opinion leader. The conceptual framework provides an outlook on how audience, communicator identity, and framing impact the communication that is utilized.

The Cooperative Extension Service (CES) and UI CES provide the public with access to reputable, research-based information. Throughout its history, CES has faced many challenges and setbacks, including changing populations and budget cuts. However, nationwide and in Idaho, CES remains well utilized and serves as an important asset to increase healthy living, agricultural productivity, and positive youth development.

This research helps to provide further insight into how extension faculty and educators currently communicate with their audiences; and what the relationship is between their science communicator identities and the communication type they most commonly use. Due to the urbanization nationwide, and the growing population in Idaho, UI Extension has had to adapt. This study aids in demonstrating how UI Extension faculty and educators are adapting their communication to target new audiences while maintaining its trusted relationship with rural audiences. This study also adds to the sparse research on social identity of extension professionals.

Cooperative Extension Service

The land-grant system is made up of three separate components functioning together to diffuse research-based information to the public: academic institutions, experiment stations, and CES (National Institute of Food and Agriculture [NIFA], n.d.-b). Formal academic instruction institutions were the first component of the land-grant system. These institutions allowed the working class opportunities for further education (Texas A&M Agrilife Extension Service, n.d.). They provided formalized education opportunities for agriculture and mechanical arts to be taught (NIFA, n.d.-a). New funding for experiment stations was formalized, and research and innovations began benefiting farmers. Lastly, the third component of the land-grant system, extension, was founded. The goal of extension was to serve as a cooperative service between federal, state, and local governments to provide farmers and rural populations with the research-based information that was being produced by the agricultural institutions and experiment stations (Seevers & Graham, 2012). Much has changed since the founding of the land-grant system and CES. However, they continue to work collaboratively and continue to carry out the land-grant mission of providing the public with helpful and trustworthy information (NIFA, n.d.-a).

Academic Institutions

Non-formal education systems that transformed into CES can be traced back to the conclusion of the American Revolution in the 1800s (NIFA, n.d.-a). Agricultural societies began emerging across the U.S. to problem solve, communicate farming achievements, and conduct agricultural experiments (NIFA, n.d.-a.; Seevers & Graham, 2012). These societies were present at state and county levels and used publications to communicate their innovations and news (Seevers & Graham, 2012). Agricultural journals and bulletins were

published periodically to communicate new findings and provide resources to American farmers (Seevers & Graham, 2012). With the support of agricultural societies, the first college of agriculture in the U.S. was established in 1855 in Michigan, soon followed by colleges in Pennsylvania and Maryland (Seevers & Graham, 2012). The establishment of these schools provided opportunity for agricultural innovation and education; however, they struggled due to lacking resources (Seevers & Graham, 2012).

Representative Justin Morrill introduced a bill aimed to provide better support for these agricultural and mechanic institutions in the U.S. (Seevers & Graham, 2012). This bill also provided opportunities for new institutions to be established. The Morrill Act was signed into law in 1862 and provided federally donated land and funding to each state to establish institutions to teach agriculture, mechanical arts, and military tactics (North Carolina State Extension, 2005). These formal agricultural institutions became the first component of the land-grant system. The new institutions sought to help the people of the working class by providing accessible information about farming innovations (North Carolina State Extension, 2005). The Morrill Act was expanded in 1890 to provide funding for Historically Black Colleges and Universities (HBCUs) to become land-grant universities (Ohio State University, n.d.). It was expanded again in 1994 to include 29 tribal colleges and universities (NIFA, 2019). These land-grant institutions would serve as the home for CES in each state that would later be formalized by the Hatch Act.

Experiment Stations

Agricultural experiments were occurring throughout the nation in the mid-1850s. The first experiment station was established in Connecticut in 1875 (Seevers & Graham, 2012). Other states, including California and North Carolina, quickly followed and began

developing their own areas for experiment stations (Seevers & Graham, 2012). These newly founded experiment stations were helping farmers find solutions to problems and issues they were facing. However, experiment stations were largely understaffed and needed more support (Seevers & Graham, 2012).

Seaman Knapp from Iowa started lobbying for funding and governmental support for current and new experiment stations and the Hatch Act of 1887 was put into law. The Hatch Act established experiment stations with the purpose of finding and broadcasting research-based knowledge to farmers and students (North Carolina State University, 2005). The experiment farms, which would evolve into today's experiment stations, were a sector within the established land-grant universities and became the second component of the land-grant system (Seevers & Graham, 2012).

Cooperative Extension Service

Information found through these experiment stations and other agricultural research was also made available to communities through "moveable schools". This concept originated in 1899 to help bring new technology and ideas to black farmers via a mule-drawn wagon (Seevers & Graham, 2012). This concept was expanded upon in 1903 and trains were utilized for the moveable schools and transportation of professors, educational materials, and other innovations (Seevers & Graham, 2012). This method of transporting information to rural communities helped establish the importance of continuing the transmission of information uncovered at land-grant universities through research to rural communities and farmers throughout the U.S. (Seevers & Graham, 2012).

Knapp aided in the development of agricultural demonstrations, and later became known as the "Father of Extension" (Seevers & Graham, 2012). Knapp had a passion for

agriculture and helping farmers to use better and more efficient practices. He gained farmers' trust by utilizing in-person demonstrations to show farmers how these new techniques worked (Seevers & Graham, 2012). Demonstration farms were established in 1903 to present farmers with solutions to production issues they were facing. These demonstration farms proved themselves to be successful and this idea spread throughout the farming communities in the south (Seevers & Graham, 2012). These agricultural demonstrations and movable schools worked collaboratively to bring information to rural areas and black farmers. The success of these models indicated a need for an established and formal extension system (Seevers & Graham, 2012).

In 1914, the Smith-Lever Act was signed into law and formalized CES; the third and final component of land-grant universities (Seevers & Graham, 2012). This act established the partnership between the USDA and land-grant universities. It provided funding to continue research and share the results directly with the public (North Carolina State Extension, 2005). This act and the formalization of CES strengthened the service to communities and increased the reach of agricultural demonstrations, research, and experiment farms (Seevers & Graham, 2012).

During this time, more than 50% of the U.S. population lived in rural areas and 30% were employed by agriculture (NIFA, n.d.-a). The purpose of the extension system was to continue to address issues that rural America and its communities were facing and provide them with information they could easily understand and utilize (NIFA, n.d.-a). Early program areas in extension included agriculture, home economics, economic development, and community leadership. These program areas are still part of CES today (Buys & Rennekamp, 2020).

The adaptability of CES and extension professionals was heavily tested during World War I, the Great Depression, and World War II. During World War I, CES was able to help the U.S. meet its needs by significantly increasing wheat acreage and communicating ways to can and preserve perishable food items (NIFA, n.d.-a). During the Great Depression, extension professionals began focusing on economics of the farm and providing information about marketing crops and organizing cooperatives (Seevers & Graham, 2012, NIFA, n.d.-a). During these times, women on the farm were able to access information from extension professionals about nutrition, canning, gardening, and other home-making skills (NIFA, n.d.-a). After World War II, CES remained an important resource for agricultural producers throughout the U.S. (Seevers & Graham, 2012).

Cooperative Extension Service (CES) in Current Times

Today, individuals who farm for a living make up less than 2% of the population in the U.S., and less than 17% live in rural areas (NIFA, n.d.-a). The primary goal for CES in rural areas is still to help farmers and ranchers increase productivity and gain access to new research-based information but the goal has also expanded to assist in the improvement to the health of these communities (Seevers & Graham, 2012). However, extension program areas have continued to expand to encompass the needs of the growing and urbanizing population. Today there are CES offices and staff in approximately 3,000 counties nationwide (NIFA, n.d.-b). As agriculture has continued to evolve and adapt to current times, so has CES.

Idaho Cooperative Extension Service (CES)

The UI Extension system was founded in 1889 and has gone through many growing times and challenges. Throughout the years, UI Extension has seen rapid expansion of staff and experimental locations, followed by severe budget and staffing problems (Anderson,

1995). However, UI Extension has proven its longevity by being adaptable in serving the growing and changing population of the state. Similar to CES in other places in the U.S., UI Extension put an emphasis on providing research-based information with communities with Experiment Station Bulletins from its inception (Anderson, 1995). Early personnel of UI CES noted the importance of two-way communication channels to continually answer farmers and ranchers' questions (Anderson, 1995). Today, UI Extension has 45 offices in four districts, with staff in 42 counties, over 120 employees, and over 15 program areas throughout the state.

UI Extension History. UI was founded in 1889 by the Board of Regents and utilized the Morrill and the Hatch acts to provide funding for the new university (Anderson, 1995). The Idaho Agricultural Experiment Station was developed on the campus in 1892. During the 1890s, two-day educational gatherings put on by professors from the university were held around the state. These were known as Farmers' Institutes (Anderson, 1995). In 1905, the meetings were held in seven counties and 5,000 people attended in total (Anderson, 1995).

Demonstrations and moveable schools began in Idaho to help bring new innovations and research from the university to the rural populations (Anderson, 1995). The Board of Regents of the University of Idaho called for the development of more experiment stations (University of Idaho College of Agriculture, 1892-a). Due to Idaho's diverse landscape and climates, they were to be scattered throughout the state to help further agricultural research in those areas (Anderson, 1995). Station No. 1 was near Grangeville, Station No. 2 was near Idaho Falls, and Station No. 3 was near Nampa (University of Idaho College of Agriculture, 1892-b). The purpose of these stations was "to discover what is unknown, in fact, principle, or application in any branch of agriculture. What is unknown must be found by research, not

by accident, and requires knowledge, accuracy, judgement, and industry" (University of Idaho College of Agriculture, 1982 b, p. 1-2). By 1896, these experiment stations were abandoned due to a lack in funding, location, staffing problems, and issues with crop and experiments (Anderson, 1995). Agricultural research expanded again, and an experiment station was opened up near Caldwell in 1906 (Anderson, 1995). New stations were founded near Felt, Sandpoint, Aberdeen, Gooding, and Jerome in following years; scattered again throughout the state to encompass the diverse crops and landscape (Anderson, 1995).

The College of Agriculture at UI was officially established in 1901. The Department of Domestic Science, now referred to as Margaret Ritchie School of Family and Consumer Sciences, was established in 1902 (Anderson, 1995). Both the college and this department remain at the center of UI Extension today. In 1910, the first extension program was started in Boise and had two staff members. The extension office soon expanded to include positions and program areas for animal husbandry, entomology, horticulture, pure seed, and home economics. Extension steadily increased in Idaho, and by 1947, UI Extension had expanded into 42 counties (Anderson, 1995). The UI Agricultural Extension Service became the UI CES in 1970.

Once the U.S. entered into World War II, the government called for a focus on increased food production to help the military (Anderson, 1995). Idaho farm families responded to this call. It was the job of the extension professionals to provide resources to assist farmers in meeting the new goals (Anderson, 1995). Extension professionals trained volunteers to help communicate the information with farmers and their families. Following World War II, it was the job of extension professionals to adapt with the times and needs of the communities and farmers, "while conducting educational programs around the state, UI

Extension Service agents and faculty were asked to deal with perplexing problems and difficult situations. At that point, the UI educators became troubleshooters" (Anderson, 1995, p. 139).

Communication Methods. Upon establishment of funding for the first experiment stations in Idaho, the Agricultural Experiment Station (AES) Bulletin began publication to update the public on the progress of the stations and was available to anyone who signed up for it (University of Idaho College of Agriculture Bulletin No. 1, 1982). Bulletin No. 1 was published in September of 1892, titled “Organization and Progress of Work at the Experiment Stations”. It described the progress that had been made at the first three experiment stations and concluded by emphasizing that the farmers of Idaho are the ones who will benefit from these stations and the information that is discovered at them is owned by the people of Idaho (University of Idaho College of Agriculture Bulletin 1, 1892).

The publication of these bulletins continued. Content of the bulletins expanded over the years and each experiment and program area began publishing their own with new research ventures and findings. This model of communication has shown from an early time the importance of extension professionals to communicate research with constituents. These bulletins are still being utilized today, but now are fully accessible online. Each program area within the state has their own periodic publication. Some publications are available in hard copy, and others can be found through the UI Extension website and social media accounts (University of Idaho Extension, 2018). New technology and the internet have allowed Extension resources to be more easily accessible throughout the U.S. and the world. Today, extension information is available through land-grant university websites, publications, and the eXtension website (NIFA, n.d.-b).

UI Extension in the 21st Century. Today, UI Extension serves the entire state of Idaho with personnel and 45 offices in 42 counties and nine research and extension centers (University of Idaho, n.d.). UI Extension also provides support to three federally recognized tribes (University of Idaho, n.d.). In 2019, UI Extension had 87 Extension Educators and 32 Extension Specialists (University of Idaho, 2019). Funding for extension and its programs comes from federal, state, and county levels and grants are also utilized. UI Extension program areas include: 4-H and youth development, cereals, community development, family finance, farm and ranch management, food safety, forest management, horticulture, human health and nutrition, land and livestock, pests and weeds, potatoes, small farms and food systems, soil, water, waste, and air management, and sugar beets and minor crops. Each of these program areas also includes numerous outreach projects and research throughout the state (University of Idaho Extension, n.d.).

UI Extension still has major impact on communities and constituents through major program areas - Eat Smart Idaho, Farm Succession Planning, Master Gardener, and 4-H (University of Idaho, n.d.). Sixteen schools and over 1,100 adults participated in Eat Smart Idaho classes (University of Idaho Extension, 2018). A reported $32 million worth of farm assets were protected by farm succession planning workshops (University of Idaho Extension, 2018). Twenty counties held Master Gardener classes and the Idaho Landscape and Garden website received over 85,000 views (University of Idaho Extension, 2018). 4-H has continued to have an immense impact on the youth of Idaho with 73,478 participants in 4-H youth programming (University of Idaho, 2019). An estimated $760 on food per week was saved by participants of a cooking school that adopted the practices of the program (University of Idaho Extension, 2019). UI Extension continued to have a major impact on

agricultural producers. For example, in 2019 growers saved over $5.5 million and used 85,500 less gallons of chemicals after they subscribed to PNW Pest Alert (University of Idaho, 2019).

Online communication and access to information has become a priority for UI Extension. The UI Extension online catalog has approximately 700 publications on 65 different topics (University of Idaho Extension, 2018). UI Extension produced 90 peer-reviewed publications and 65 professional and scientific journal articles (University of Idaho, 2019). Education videos have been produced and published online to increase the access of the research-based information. In 2019, UI Extension website received over 832,000 views (University of Idaho Extension, 2019). Social media presence has also become important, and now UI Extension boasts active Facebook and Twitter accounts. Despite technology and communication advancing, in 2019, there were over 440,000 reported face-to-face interactions with UI Extension professionals statewide (University of Idaho Extension, 2019).

Four Districts of Cooperative Extension in Idaho

The CES in Idaho is broken up into four districts: northern, southern, central, and eastern. These four districts encompass diverse agricultural production practices and commodities. The population demographics, rural and urban makeups, and constituent and community needs in these four districts are diverse as well.

Northern District

This region encompasses Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, Lewis, and Nez Perce Counties. Shoshone County does not have a county extension office but gets resources from surrounding counties. According to UI Extension

(2017), this area has the highest percentage of seniors, highest child poverty rate, highest percentage of adults with a high school diploma, and the smallest number of farms in the state. Coeur d'Alene, Post Falls, and Hayden are the biggest cities in the northern district. There are a reported 1213 farms with forage, wheat, oats, barley, Christmas trees, and cattle are the main commodities of this district (USDA, 2017). Hispanics make up 3.4% of the population (U.S. Census Bureau, 2019).

Southern District

This district includes Ada, Adams, Boise, Canyon, Elmore, Gem, Owyhee, Payette, Valley, and Washington counties. As of 2017, this district saw the highest rate of job growth, the lowest poverty rates, the highest percentage of teens age 16-19 without a job and not in school, and the highest percentage of small acre farms (University of Idaho Extension, 2017). This district accounts for a large portion of Idaho's population with three of its largest cities: Boise, Meridian, and Nampa. Boise has continued to be one of the fastest growing cities in the nation with an 18.2% population growth from 2010 to 2018 (Warren, 2019). This has caused an increase in rent and other costs of living. This district has 2289 farms, with forage, wheat, corn, silage, sugar beets, dairy cattle, beef cattle, and layers being main commodities (USDA, 2017). Hispanics make up 29.2% of the population (Census, 2019).

Central District

This district encompasses Blaine, Camas, Cassia, Gooding, Jerome, Lincoln, Minidoka, Oneida, and Twin Falls counties. The central district has the highest percentage of Hispanics and Spanish speakers, the highest percentage of adults without a high school diploma, and the highest percentage of jobs associated with farming (University of Idaho Extension, 2017). Twin Falls, Jerome, and Burley are the largest cities within the district.

29.2% of the population in the central district are Hispanic (Census, 2019). There are 538 farms; silage, forage, corn, potatoes, dairy cattle, beef cattle, and sheep are top commodities in the central district (USDA, 2017).

Eastern District

Bannock, Bear Lake, Bingham, Bonneville, Butte, Caribou, Clark, Custer, Franklin, Fremont, Jefferson, Lemhi, Madison, Power and Teton counties make up this district. This district has the lowest rate of population growth, highest percentage of Native Americans, lowest per capita income, highest poverty rate, and the largest number of farms (University of Idaho Extension, 2017). Five counties in this district are classified as 100% rural (University of Idaho 2017). Idaho Falls, Pocatello, Ammon, Chubbuck, and Blackfoot are the most urban areas within the eastern district. Hispanics make up 13.4% of the population in this district (Census, 2019). There are 1109 farms, and barley, wheat, potatoes, cattle, and sheep are top commodities (USDA, 2017).

Theoretical Framework

Social identity theory, diffusion of innovation theory, and framing theory serve as the theoretical foundation for this study. Social identity theory indicates that if an individual identifies as being part of a group, they are more likely to act out the norms and values associated with that specific role (Tajfel, 1974). Extension professionals who believe they are science communicators are more likely to have actions that align with science communication norms. Framing theory indicates that a message that is targeted to one specific group or segmented audience is more likely to be accepted (Dameen et al., 2001). Extension professionals can use this concept to prepare communication specifically for their audiences. Lastly, diffusion of innovation theory outlines the importance of opinion leaders

in diffusing information within a community (Rogers, 2003). Extension professionals should recognize their jobs as opinion leaders and use that platform to help transmit the research-based information that extension is known for.

Social Identity Theory

How an individual perceives that they belong to a group, organization, or title has an influence on their actions surrounding their identity (Tajfel, 1974). According to Tajfel (1974), an individual's social identity is "part of an individual's self-concept which derives from his knowledge of his membership of a social group together with the emotional significance attached to that membership" (p. 69). Participating and contributing to change, and an individual's commitment to a group is largely based upon their social identification (Stets & Burke, 2000). Society is naturally structured to have specific groups to which individuals self-identify (Stets & Burke, 2000). Social identity theory examines the similarities between the individual and the group, and other individuals within the group. Similarities within the group include, "all the attitudes, beliefs and values, affective reactions, behavior norms, styles of speech, and other properties" (Stets & Burke, 2000, p. 225).

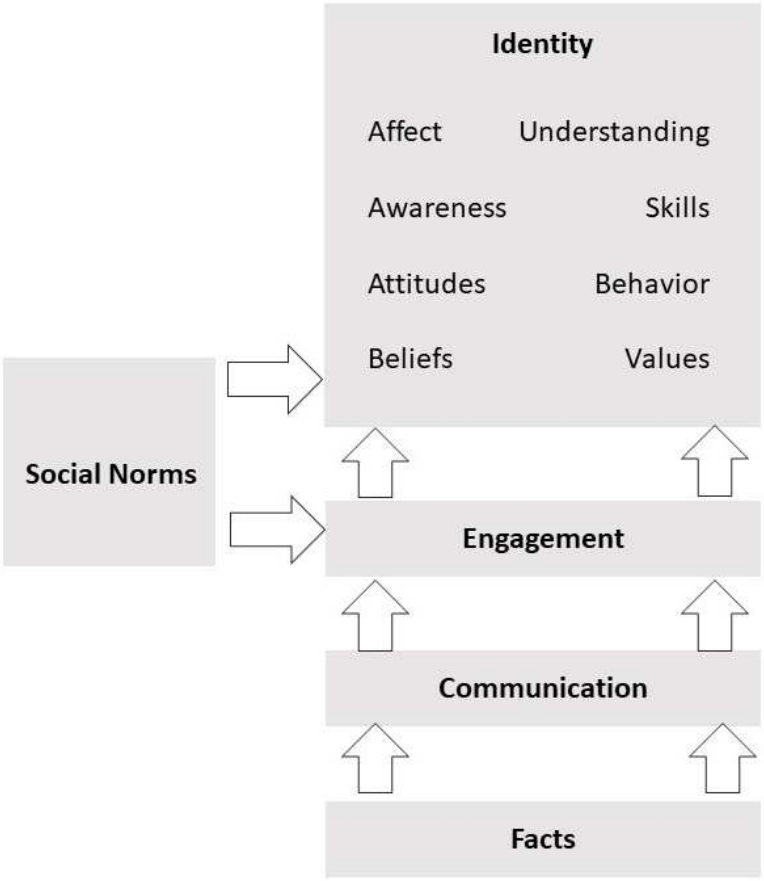
The roles and social identities of extension professionals have adapted throughout the years. In the beginning, those who worked for land-grant universities and experiment farms were tasked with writing down the work and research being done (Donnellan & Montgomery, 2005). These individuals transformed from "scribes" into "editors" and finally into communicators of research-based information (Donnellan & Montgomery, 2005). Through these transitions, the importance of balancing job duties as communicators and research or support roles has emerged (Donnellan & Montgomery, 2005). Communicating and maintaining public relation channels with the public is vital to help carry out CES goals.

When extension professionals act as communicators, they assist in maintaining positive two-way channels with constituents and support the mutual good of CES (Donnellan & Montgomery, 2005).

Longnecker's (2016) Integrated Model of Science Communication. Longnecker's (2016) integrated model of science communication was adapted for this study. This model depicts the process and inputs that take place for facts to be communicated. Major components of the model include identity, engagement, communication, facts, and social norms (Longnecker, 2016). Facts are the foundation of this model; they are readily available for individuals to receive and communicate. Individuals then engage with others to communicate these facts (Longnecker, 2016). Social norms act as an external factor that impacts an individual's identity and if they engage with others in the communication process (Longnecker, 2016). The identity portion is, "a key aspect that determines their engagement with information and its use" (Longnecker, 2016, p. 3).

Figure 2.1

Adapted Model of Longnecker's (2016) Integrated Model of Science Communication



Identity is supported by eight factors: affect, awareness, understanding, skills, behavior, attitudes, beliefs, and values (Longnecker, 2016). The affect factor includes an individual's motivation to communicate scientific information (Parrella & Leggette, 2020). The awareness factor includes the individual's awareness of science resources (Longnecker, 2016). The understanding factor consists of the individual's knowledge of what it means to be a science communicator (Longnecker, 2016). The skills factor includes how they utilize science communication concepts and apply them to communicate more efficiently (Parrella

& Leggette, 2020). Behavior, in this model, relates to how an individual seeks out new training and applies that training to their communications (Longnecker, 2016). The attitude factor includes how an individual believes they fit into and portray themselves as being a science communicator (Longnecker, 2016). The beliefs factor relates to how individuals believe science communication is valued and relates to the scientific field (Parrella & Leggette, 2020). Lastly, the values factor consists of what values are important in science communication and how they uphold them in their communication interactions (Parrella & Leggette, 2020). This model considers an individual's identity to be vital in being an effective science communicator, "a sense of identity affects engagement with information – whether we receive it, how we process it and what use we make of it" (Longnecker, 2016, p. 5). In this model, specifically identity and the eight contributing factors, serve as the theoretical foundation for understanding one's identity as a science communicator.

Those who understand that they can communicate scientific information and have adopted the identity of a science communicator are more likely to participate in scientific communication, support others who communicate, and reach out to collaborate with other science communicators (Baram-Tsabari & Lewenstein, 2017). The identity as a communicator can be an addition or expansion of one's current professional identity; the new identity as a communicator can help broaden their reaches in their discipline (Baram-Tsabari & Lewenstein, 2017).

Social identity theory lays the foundation for evaluating how individuals within UI CES perceive themselves as communicators and how they align themselves with the relevant goals and missions. An individual is more likely work cohesively with others to benefit the common good of the company and to meet goals if they associate themselves as part of the

group (Jackson & Smith, 1999). Those who are not positively associated with their organizational goals and values, or do not identify as part of the "in group" might not have the drive or ambition to meet the set standards and goals (Jackson & Smith, 1999).

Framing Theory

Extension serves as a two-way channel to transmit the research-based information from land-grant universities to the public and in return address the publics' questions and further problems and concerns (Donnellan & Montgomery, 2005). Extension allows access to information that is relevant to the public's needs (Buys, 2020). In order to carry out this goal, information needs to be prepared and presented to constituents in ways that are interesting and easily understood. According to framing theory, messages that are tailored for a specific audience are more effective than those broadcast for the public (Dameen et al., 2001). Using the concepts and strategies of framing theory, information should be presented to constituents in a way that is intriguing and easy to understand, while remaining trustworthy and valid (Robinson, 2013).

Extension has proven itself to be effective at framing messages for its audience throughout history. It has successfully helped farmers to continually adopt research-based information benefiting crop and livestock production (Buys, 2020). Disseminating these innovations has helped the U.S. become a leader in food production (Buys, 2020). The impact of extension and its information can be improved if an audience's needs are understood. Information can then be prepared and delivered using an appropriate medium (Agunda, 1998).

When communicating information that might be intimidating or confusing, it is important that extension professionals frame the information in a way that is familiar and

easily understood (Jenkins et al., 2020). Message framing in these contexts can include making the information relatable, communicating shared values, emphasizing familiarity, and humanizing the process (Jenkins et al., 2020). These guidelines and framing techniques can make the information more influential and strengthen the relationship between the extension professional and constituent. In turn, this can make extension more important and impactful for the audience (Jenkins et al., 2020).

Framing a message can impact an individual's behavior and support for the subject matter (Li & Su, 2018). For example, scientific information regarding climate change is framed to focus on the economic, environmental, and moral factors had an impact on the individual's behaviors, concerns, and support for policy change (Li & Su, 2018). Demographics, political beliefs, and cultural values and norms impacted individuals' views on scientific information and what sources they utilized to seek out new information, "therefore, appropriate message frames should be developed to tailor target audiences' specific values and backgrounds to maximize their persuasive effects" (Li & Su, 2018, p. 11).

Audiences are more likely to become interested and utilize information that is relevant to themselves and their needs. Using the concepts and strategies of framing theory can be beneficial in effectively communicating new information to new target audiences (Robinson, 2013). The U.S. is becoming increasingly urbanized and the foundation of extension needs to continually adapt to these changes. Communicators need to provide more than broad messages; instead, they should understand their audience and formulate a communication plan tailored for them. This information will help to appropriately frame information to reach the audience (Agunda, 1998). Extension professionals should utilize the

concepts of framing theory to help transmit information effectively to current and new constituents.

Diffusion of Innovation Theory

Extension professionals rely on constituents to be receptive and accept the information they are providing. Rogers (2003) defines the process of diffusion, "by which an innovation is communicated through certain channels over time among the members of a social system" (p. 11). It is believed communication channels and the social system in which the information is being spread has an impact on how the information travels and how constituents perceive it (Rogers, 2003). Mass media can provide the most efficient channel of communicating new information with large groups of people. However, interpersonal channels can increase the likelihood of audience reception and acceptance of information; especially if those involved in the communication have similarities or personal links (Rogers, 2003).

The innovation-decision process examines how new information is spread by opinion leaders through a five-step process (Rogers, 2003). The five steps are: knowledge, persuasion, decision, implementation, and confirmation. The knowledge stage occurs when an individual becomes aware of new information; often an outside source or opinion leader brings new information to an individual to start this step (Rogers, 2003). During the persuasion stage, the individual begins forming an opinion about the new information they were exposed to (Rogers, 2003). The choice to adopt or reject the new information happens during the decision stage of the innovation-decision process (Rogers, 2003). The implementation stage happens after the individual has chosen to accept the information and then puts it to use (Rogers, 2003). The last stage of this process occurs when an individual

reassesses the information and their decision to accept it (Rogers, 2003). Constituents rely on the opinion leader to provide them with the new information, then they will begin the innovation-decision process.

The diffusion of innovation theory and innovation-decision process has been utilized by extension professionals for many years (Stephenson, 2003). For example, extension professionals studying hybrid corn recognized a few key farmers accepted the new corn, and their communication with other farmers about the new seed helped to spread the innovation (Stephenson, 2003). This model of diffusing information is still utilized by CES today. Extension professionals act as opinion leaders to present new innovations or information and rely on early adopters to help diffuse the innovation to others (Stephenson, 2003). Agricultural opinion leaders have been shown to have an impact on the diffusion of information (Islam et al., 2016). Their impact through this role can be increased through heightened focus on innovativeness, organization participation, agricultural knowledge, motivational activities, and a diffusion network through local leaders (Islam et al., 2016). Opinion leaders need to have key similarities with the group they are communicating with and tailor the information for the specific group as this will increase the likelihood of acceptance (Rogers, 2003). Opinion leaders working in agriculture have preferred communication channels (Lamm et al., 2016). These channels are influenced by their level of opinion leadership (Lamm et al., 2016). Opinion leaders also have shown optimist characteristics and tended to be less risk seeking (Lamm et al., 2014).

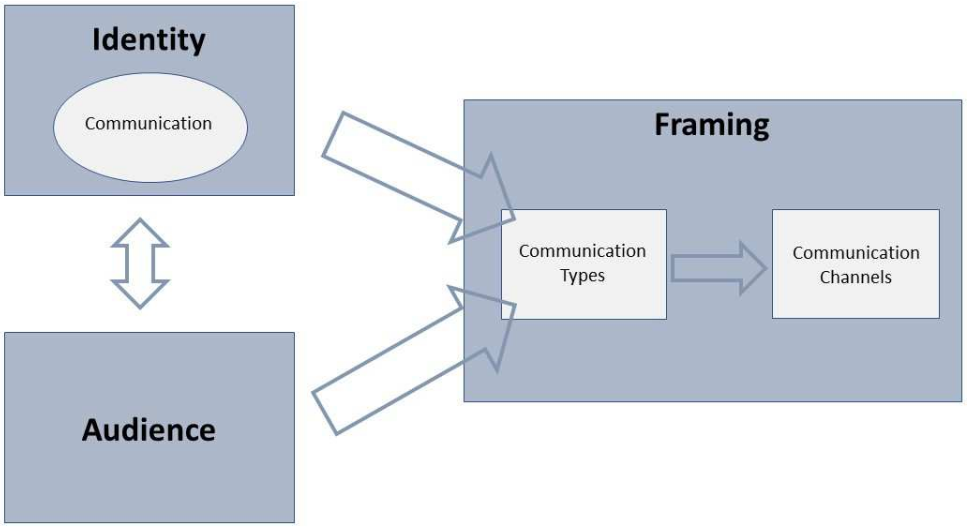
The diffusion of innovation theory emphasizes the importance of opinion leaders and stakeholders in the communication of new information (Rogers, 2003). These individuals are influential sources that can greatly impact the constituent's decision to reject or adopt the

new information. Extension professionals who understand their roles as an opinion leader can help to initiate this process. This can positively impact the community and CES by spreading needed information and keeping relevant information flowing to constituents (Rogers, 2003).

Conceptual Framework

Figure 2.2

Conceptual Model of the Relationships between Identity and Communication Preferences



This conceptual model was developed to show the impact audience, identity, and framing have on each other and communication. One who identifies with a group believing communication is important will have more effective communication styles (Tajfel, 1974). Audience and identity directly impact each other because the audience's needs will impact how the communicator prepares the information, and what kind of information they need. A strong communicator might be less effective in an audience does not have previous expose to the importance of the information. Identity and audience directly influence the communication types that should be utilized (Agunda, 1998). A small audience group

requires a different communication type than a large public meeting. An individual's identity will also impact what type of communication they prefer and most commonly utilize (Agunda, 1998). Communication channels are dependent on the communication type. One would most likely not utilize a specially tailored newsletter for individual communication. Instead, the type of communication will directly lead to the most appropriate communication channel (Tajfel, 1974). The framing of the information, as impacted by the extension professional's identity and the audience, will then have influence on the communication types and channels utilized. Communication types - individual, group, or mass communication, dictate which communication channels are then utilized for the diffusion of information (Rogers 2003; Telg & Irani, 2012).

Identity

Research surrounding social identities of extension professionals is scarce. However, previous research does indicate that communication is an important aspect of extension. Extension professionals act as communicators and liaisons of information to assist in keeping the cyclical nature of communication in CES (Kurtzo et al., 2019). Internally, extension has a positive association with its values, organization, and culture. Those who work in extension recognize their duty to act as communication channels between the state and the public (Ray et al., 2015).

Further, aligning with organizational values and norms is important to extension professionals. To be successful communicators in their jobs, Minnesota Extension professionals listed listening, instructing, small group problem solving, small group leadership, and routine information exchange as the top five skills needed (McDowell &

Mizuno, 1987). Extension professionals indicated that a key point in their job is to link individuals to the information produced by research (Ray et al., 2015).

Science communicators want to share information based upon its impact on constituents' daily lives (Brown, 2014). The science communicator chooses the scientific information to share with an audience based upon their own personal motivations and their assumption of audience's values (Brown, 2014). Framing of information is based upon the individual communicator. It is vital to frame information as blatantly important for daily lives, as part of a personalized narrative, or a combination of the two (Brown, 2014). Those who work in a scientific field and communicate scientific information have differing perceptions of science communication and its role in their respective fields (Parrella & Leggette, 2020). Those who identify themselves as science communicators typically feel motivated to fulfill the roles associated with being a communicator (Parrella & Leggette, 2020).

Audience

The audience influences the content and the delivery of the information coming from extension professionals, "knowing the target audience's information needs, their communication characteristics, and their socioeconomic conditions is the first step in selecting the communication strategies most appropriate to serve them" (Agunda, 1998, p. 6). An audience's demographics can give extension professionals insight into age, gender, race/ethnicity, education levels, income, employment, etc. (Curtis et al., 2012). For example, younger individuals and females demonstrated a preference for informal meetings (Lamm et al., 2019). Audience segmentation can help to produce and diffuse information designed for specific audiences (Lamm et al., 2019). This information is important when planning

programs and communication. Access to updated demographic information is important for CES to tailor programs and communication (Curtis et al., 2012).

Communicators of science-based and agricultural information should act as problem solvers and target their information to specific audiences, "find out what agricultural information is needed by a given audience, identity appropriate solutions, and communicate those solutions to the audience" (Agunda, 1989, p. 19). Framing information based upon an audience's interests and needs can increase the likelihood of immediate interest or eventual adoption (Dameen et al., 2001).

Urban audiences are becoming an even larger focus of CES, but a gap in communication and programming still exists. Since CES was founded upon rural and agricultural needs, it has had to transform programming to fit newer audience needs (Fox et al., 2017). Programs and community resources should be tailored to constituent needs, as well as research-based and trustworthy (Fox et al., 2017). Urban audiences tend to be more diverse; communication and programs must be adaptable to accommodate numerous audience demographics (Fox et al, 2017). However, current programming and communication materials available in urban areas have been adapted from fundamental rural-based programming. Urban audiences can have difficulty relating and understanding information that was adapted and not designed specifically for them (Fox et al., 2017). Understanding urban audiences and their needs provides an opportunity for expansion for CES. Increasing engagement from this group can help prove the usefulness and trustworthiness of CES.

Communication Types

Extension professionals use multiple communication types to connect with their constituents. Typically, in communication research, contacts are classified into four types, interpersonal, small-group, public, and mass (Telg & Irani, 2012). Accordingly, for the purpose of this study communication contact is classified based on extension delineations into three groups: individual, group, and mass (Seevers & Graham, 2012). Individual contact is one-to-one communication and can include telephone calls, farm, home, or office visits (Seevers, & Graham, 2012). Group contact can include meetings, camps, workshops, or tours (Seevers & Graham, 2012). Mass contact involves the use of mass media including radio, social media, websites, or newsletters (Seevers & Graham, 2012). Each of these communication contact types can be beneficial in specific situations, determined by the audience's needs, preferences, and the type of information disseminated. Extension professionals should adapt their communication based upon the audience, subject, function, and time available (Seevers & Graham, 2012).

Communication techniques vary depending upon the audience. Segmenting the audience into groups based upon demographics and their perceived needs is important to make information more effective for receivers (Hine et al., 2014). Then information should be specifically tailored based upon the specific groups. When done correctly, audience segmentation and subsequent message framing have an impact on an individual's acceptance and behavior (Hine et al., 2014). When communicating with outsiders and constituents, Minnesota Extension professionals listed listening, public speaking, instructing, small group problem solving, and small group leadership as the most important (McDowell & Mizuno, 1987).

Communication Channels

When providing agricultural production information there are numerous channels utilized for information transfer – radio, magazines, newspapers, demonstrations, meetings, and workshops (Licht & Martin, 2007). Overall, producers prefer personal individual contact, specifically consultations, due to the ability to have immediate answers specific to the producer's concern or problem (Licht & Martin, 2007). Interpersonal, or individual contact communication, was deemed as the most reliable by agricultural producers in Iowa based upon the extension professional's ability to provide to-the-point information directly addressing their individual needs (Licht & Martin, 2007).

Extension professionals in Arkansas utilize many communication channels to send messages to their constituents – electronic sources, face-to-face, cell phones, print, and broadcast. Extension professionals received information most frequently through emails. Webpages and blogs have shown to be an effective and preferred way to communicate (Lamm et al., 2019). However, understanding the audience and their needs is important in determining the most effective communication channel.

Summary

CES and UI Extension have a long history of providing research-based information to the public. They have proven to be trustworthy sources, but now need to continue to adapt to provide to new and changing audiences. Utilizing the concepts of framing theory, diffusion of innovation, and social identity theory can help those communicating information better provide to their constituent needs. In this study, we aimed to explore how a UI Extension faculty and educator's science communication identity related to how their communicate with their constituents.

Chapter 3: Methods

This study is a qualitative priority, mixed methods study. It included surveys to evaluate how UI Extension educators and faculty communicate with constituents. Descriptive statistics, t-tests, and Wilcoxon Signed-Ranks test were utilized to analyze the data. Interviews were utilized to understand UI Extension educators and faculty's views on science communication and if they identify as science communicators. Interviews were transcribed verbatim and open coded for common themes. Lastly, quantitative and qualitative data were compared to determine if a relationship exists.

Research Design

This research study was designed as a non-experimental, sequential, mixed methods study with a qualitative priority. The purpose of this research is to explore how UI Extension faculty and educators identify as science communicators and what impact their identities have on the communication types and channels they utilize. Data collection was sequential with the quantitative data being collected first followed by the collection of qualitative data. Stratified purposive sampling was utilized to select participants from the survey responses for participation in interviews.

The census survey was developed using Dillman's Tailored Design Method (Dillman et al., 2014) and included 10 questions regarding their usage of different communication types and channels and nine demographic questions. The survey was administered through Qualtrics and distributed via email. Data were analyzed using SSPS version 25. Survey respondents were stratified and purposively selected for interviews to ensure a representative population. They were stratified based upon their district, county classification as urban or rural, and their communication type most commonly used.

Semi-structured zoom interviews, using a predeveloped protocol were recorded and transcribed verbatim using Dragon Diction Software. Interviews were then open coded by two researchers. To increase trustworthiness member checking and interrater reliability methods were utilized. Data from surveys and common themes from interviews were compared to find relationships. Table 3.1 outlines the research approach, analysis, and outputs for the three research questions in this study.

Table 3.1

Research Approach, Analysis, and Outputs for Research Questions

Research Question	Approach	Analysis and Outputs
RQ1: What communication types and channels are used by UI Extension educators and faculty to communicate with constituents?	Quantitative	Data from surveys were analyzed via descriptive statistics, Wilcoxon signed rank test, and t-tests.
RQ2: How do UI Extension educators and faculty describe their social identities as science communicators?	Qualitative	Interviews were transcribed and coded using open coding.
RQ3: What is the relationship between social identity as a science communicator and the communication types and channels used by UI Extension faculty and educators?	Mixing	Comparing descriptive statistics and common themes to determine relationship between communication type and science communicator identity.

Population

The target population for this study consisted of UI Cooperative Extension System (CES) faculty and educators. The individuals in this category have obtained at least a master's or doctorate degree and are working in one of the four UI Extension districts or at a research and experiment station. There are 45 extension offices in 42 of Idaho's 44 counties and nine research and experiment stations. The main program areas of UI Extension include: 4-H/youth development, cereals, community development, family finance, farm and ranch

management, food safety, forest management, horticulture, human health and nutrition, land and livestock, pests and weeds, potatoes, small farms and food systems, soil, water, waste, and air management, and sugar beets and minor crops (University of Idaho Extension, n.d.).

UI CES is broken up into four districts within the state: northern, western, central, and eastern. According to the ERS (2019), urban counties are those that have one or more urbanized area, 50,000 or more people, or contain outlying areas that are economically intertwined with urbanized areas due to work force. Rural counties are those that do not have core urban areas or economic ties due to workforce, and all others outside of urban areas (ERS, 2019). The Idaho Department of Labor (2017) classifies six counties in Idaho as urban: Ada, Canyon, Kootenai, Bonneville, Bannock, and Twin Falls. The northern district has one urban county, Kootenai (University of Idaho, n.d.). The western district contains two urban countries, Ada and Canyon counties (University of Idaho, n.d.). The central district contains Twin Falls as its sole urban county (University of Idaho, n.d.). The eastern district contains two urban counties, Bonneville and Bannock (University of Idaho, n.d.). The other counties within Idaho are classified as rural.

Each UI Extension district has a diverse landscape, population, and agricultural commodity makeup. The northern district encompasses the smallest number of farms in the state, the highest percentage of adults with a high school diploma, and the highest child poverty rate (University of Idaho Extension, 2017). Main commodity areas include forage, wheat, oats, barley, and Christmas trees (USDA, 2017). The southern district has the highest population increase, highest rate of job growth, and highest percentage of small-acre farms (University of Idaho Extension, 2017). Main commodity areas include forage, wheat, corn, and silage (USDA, 2017). The central district has the highest percentage of Hispanics and

Spanish speakers and the highest percentage of jobs associated with farming (ERS, 2019; University of Idaho Extension, 2017). Main commodities include silage, forage, corn, potatoes, and dairy cattle (USDA, 2017). Lastly, the eastern district has the lowest rate of population growth, highest percentage of Native Americans, and the largest number of farms (University of Idaho, 2017). Main commodities include barley, wheat, potatoes, and cattle (USDA, 2017).

Table 3.2 below provides the gender, race, district, department, rank, and discipline of the 131 UI Extension faculty and educators as collected by the UI CES (C. Buchert, personal communication, February 10, 2021). Individuals were classified into district and locations based upon the district in which they work, at a research and experiment center, for Extension forestry, or on the Moscow campus. Individuals were classified based upon tenure track: tenured, on track, or ineligible. For current UI Extension faculty and educators, the average years in position was 9.31 years with a high of 39 and a low of 0.

Table 3.2

Demographics of UI Extension Faculty and Educators (N = 131)

Demographic	Category	*f*	%
Gender	Male	57	43.5
	Female	74	56.5
Race	Caucasian	116	88.5
	Hispanic/Latino	5	3.8
	International	4	3.1
	American Indian or Alaska Native	2	1.5
	Asian	2	1.5
	Two or More Races	1	0.8
	Unknown	1	0.8
District/	Southern	23	17.6
	Eastern	23	17.6
	Northern	20	15.3
	Central	16	12.2
	R&E Center	35	26.7
	Other	14	10.7
Position Title	Extension Faculty	83	63.3
	Research Faculty-Ext Spec	36	27.5
	Associate Extension Educator	10	7.6
	Clinical Faculty	2	1.5

Note. Information from UI CES employment data provided by C. Buchert, personal communication, February 10, 2021. Ext Spec refers to Extension Specialist.

Sample

The initial sample population for this study included all UI Extension faculty and educators who have obtained a master's or doctorate degree. All UI Extension faculty and educators received the Qualtrics survey. Out of the 139 potential survey respondents, 89 responses were received for a 64% response rate. Responses that were missing large portions of data were discarded. Data were then sorted to only include 72 full responses for a final response rate of 52%. To handle non-response bias, early and late respondents were compared using Mann-Whitney and t-tests (Linder et al., 2001). There were no significant

differences in responses. At the end of the survey, participants were given the option to provide their contact information to be contacted for a follow-up interview.

Contact information was provided by 37 respondents. Survey respondents who provided contact information were then stratified (Creswell, 2014) based upon district, urban and rural county, and their usage of the communication types. A purposive sample was then drawn from the survey respondents using stratified purposive sampling (Creswell, 2014). Stratified sampling occurs when the researcher organizes the population based upon specific traits and selects participants from the specific groups (Creswell, 2014). Purposive sampling is specifically selecting individuals based upon their relation to the central phenomenon (Creswell, 2014). Stratified purposive sampling was utilized to ensure there was representation of individuals from each district, with consideration of rural and urban county type, and each preferred communication type. Sixteen initial interview candidates were originally selected to be interviewed. However, only 12 individuals were able to be contacted and ended up being interviewed. Missing participants were contacted via email twice and via phone three times. After contacting these individuals both via email and phone, the researchers revisited the concept of saturation (Glaser & Strauss, 1967) and saturation was determined to have been met with the 12 interviewees.

Instrumentation

This research study included both qualitative and quantitative data collection. A survey instrument was developed and used to collect data about extension faculty and educators preferred and most commonly used communication channels and types. The survey also included demographic questions. An interview protocol was utilized to gain an understanding of extension professionals' social identities as communicators.

Survey

A census survey was developed following the concepts of Dillman's Tailored Design Method and distributed using Qualtrics (Dillman et al., 2014). This survey was distributed via email and included 10 questions regarding the individual's communication behavior and preferences and nine demographic questions. Respondents indicated how often they utilized communication channels during a normal year, before COVID-19 pandemic restrictions, and during the COVID-19 pandemic. The communication channels listed were Facebook, Instagram, Twitter, YouTube, other social media, walk-in/in person, text, phone call, email, mailed newsletter, emailed/online newsletter, website, magazine, radio, television, or other. Respondents ranked their usage of each of these channels based upon a 6-point Likert scale: never, monthly, biweekly, weekly, daily, or more than daily.

Respondents indicated what percent of their time communicating was spent in each of the communication types: individual, group, and mass (Seevers & Graham, 2012). Respondents categorized their time by entering the appropriate percentage for each communication type in a typical year. Respondents were again prompted to answer the two questions regarding which communication methods were utilized the most and what percentage of their time was spent communicating via each communication type, in reflection of the year spent adhering to COVID-19 restrictions.

Respondents were then asked to enter a numerical value that represented what percentage of their time during a typical week they spend communicating with their constituents and what percentage of their time they spend preparing communication materials both prior to and during COVID-19. They then ranked the communication channels that they most preferred to those they least preferred; followed by ranking the communication

channels from most preferred by constituents to least preferred by constituents. Two open-ended questions were asked regarding the impact COVID-19 has had on their communication and how they think COVID-19 will impact extension long term. Open-ended questions were utilized to gain rich, in depth information about a specific the topic area (Dillman et al., 2014). Open-ended questions provide an opportunity for the respondent to answer freely and not restrict their answers (Dillman et al, 2014).

The survey concluded by asking for demographic information. Demographic questions included: age, gender, position title, county, race/ethnicity, program area, how long they worked in extension, and how long they have worked in UI Extension. Participants entered a numeric value for their age and years working for extension and UI Extension. Participants were given drop down lists to choose their county, program area, rank, position title, tenure track, district/location, gender, and race/ethnicity. Respondents were given the option to enter their contact information to participate in the follow-up interview.

Interviews

One-on-one interviews were utilized to understand how UI Extension faculty and educators identified themselves as science communicators and what role communication plays in their jobs. These interviews took place via Zoom and were an average of 26 minutes long and ranged from 15 minutes to 53 minutes. The interviews were semi-structured in nature using a pre-set interview protocol with 16 questions. Time was allotted in the interviews for anecdotal conversations if needed. The interview protocol utilized in this study was adapted from Jean Parrella and Dr. Holli Leggette's (2020) protocol which was based on Longnecker's (2016) integrated model of science communication. Each of the eight components of the model were addressed by questions within the interview protocol. The

questions to address each factor were as follows: understanding (three questions), affect (one question), values (two questions), awareness (one question), skills (three questions), behavior (two questions), attitudes (two questions), and beliefs (two questions).

Data Collection

Data was collected sequentially with quantitative data being collected first. Upon the conclusion of surveys, qualitative data was collected using interviews. Data collection for this study was in accordance with the UI Institutional Review Board and followed the timeline depicted in Table 3.3. The survey was sent via email to UI Extension faculty and educators. Two follow-up emails were sent in accordance with Dillman's Tailored Design Method (Dillman et al., 2014).

During the surveys, participants consented to take part in the study and answer questions truthfully and to the best of their ability. Surveys were confidential and took approximately 15 minutes to complete. At the end of the survey, respondents were given the option to provide their contact information, if they were willing to take part in the follow-up interview. Upon finishing the surveys, participants who provided their contact information were stratified into groups based upon communication type most commonly used, district, and county type. Individuals were invited to take part in the follow-up interviews through emails and phone calls. Four individuals were contacted via phone and email but failed to respond and set up interviews. The final number of participants were six from rural counties and six from urban counties. Three individuals were from the northern district, two from central district, three from eastern district, and four from southern district. Five individuals most commonly used group communication, four used individual communication, and one

used mass communication. One participant used both mass and group communication the most, and one participant used individual and group communication most frequently.

Table 3.3

Data Collection Timeline

Date	Event
March 1	Surveys distributed
March 8	First reminder
March 15	Second reminder
March 16	Surveys close
March 22	Select and contact interview sample
March 25	First Interview
April 8	Last Interview
April 10	Survey data analysis
April 19	Interview Coding
April 22	Analysis of survey and interviews

Note. All dates were in the year 2021

Semi-structured Zoom interviews were utilized to provide insight into how the selected participants identified themselves as science communicators. At the start of the interviews, participants verbally responded to a consent statement and agreed to take part in the study, for the zoom to be recorded, as well as to answer the questions truthfully and to the best of their ability. Interviews followed a pre-set protocol adapted from Longnecker's (2016) integrated model of science communication and Parrella and Leggette's (2020) protocol. Interviews had an average time of 26 minutes and ranged from 15 minutes to 53 minutes.

Data Analysis

The data collected from the Qualtrics surveys was used to describe how UI Extension faculty and educators communicate with their constituents. Descriptive statistics show how each score relates to the others (Creswell, 2014). Communication channel usage was rated

based on 6-point Likert scale were coded from 1 to 6; with 1 being a communication channel is never used and 6 being the communication is used more than daily. This coding aligns with the guidelines of Likert scale scoring according to (Ary et al., 2010). This data was analyzed via descriptive statistics, using SPSS version 25. Wilcoxon signed rank tests, t-tests, and descriptive statistics, including frequencies (*f*), means (*M*), standard deviations (*SD*), and percentages (*P*) were used to describe the respondents preferred communication types and channels.

The interviews were transcribed verbatim and masked to remove all identifying information prior to the coding process. The interviews were then deconstructed and broken apart into meaning units (Yin, 2011). An iterative process was employed to provide rigor and increase the credibility of the coding and meaning making process (Creswell, 2014). Two researchers read each meaning unit and open-coded the singular units of data into codes and subcodes (Creswell, 2014). A constant comparative method was used through open coding followed by axial coding to make meaning of the codes (Yin, 2011). The two researchers then discussed the codes for interrater reliability and to identify patterns for emergent themes. The method of interrater reliability provides multiple opinions and can negate any bias one member might have had (Creswell, 2014). Researcher reflexivity was utilized to understand implicit bias that may have been present. This collaborative process continued until the researchers agreed upon meaning. Member checking was then utilized to validate the accuracy of the quotes and themes coded from the interviews. Member checking is allowing participants to review the researchers' interpretation and coding of the data to ensure the true meaning of their information was evident (Ary et al., 2010).

This meaning making process resulted in five themes: continual development, technology, evaluation & motivation, and community relationships. The meaning units that fell into each theme were then examined for their relationship to the eight factors of identity according to Longnecker's (2016) integrated model of science communication are affect, understanding, awareness, skills, behavior, attitudes, beliefs, and values. This analysis process included stratifying the meaning units that were previously coded for each theme based on the factor the interview question was developed to explore. The stratified meaning units were then compared to identify how each theme related to Longnecker's (2016) integrated model of science communication.

To understand further the relationship between communication preferences and the identity as a science communicator, the responses to common themes were stratified based upon the interviewee's communication type in each theme. These stratified piles in themes were compared with cross case comparison to examine the similarities and differences in the way the theme was discussed based on communication type. If shared patterns were not identified, no significant influence was designated. Incomplete data sets were discarded. Data was considered incomplete if there was less than 60% of the interviewees in each communication type not represented in the theme.

Summary

This study was a mixed methods study with a qualitative priority. Surveys were utilized to gain an understanding into how UI Extension educators and faculty communicate with their constituents. Survey data were analyzed using descriptive statistics, t-tests, and Wilcoxon signed rank tests. Interviews were conducted to understand how UI Extension educators and faculty view themselves as science communicators. These interviews were

recorded, transcribed verbatim, and open coded for common themes. The data found in the interview and the surveys were mixed to see what relationship existed between the individuals grouped based on their most commonly used communication type and their views regarding science communicator identity.

Chapter 4: Results

The purpose of this research was to examine how UI Extension faculty and educators identify as science communicators and the relationship between their identities and the communication types and channels they utilize. The sample was composed of UI Extension faculty and educators who have received at least a master's degree. This study can benefit UI Extension and CES by giving an insight to how Extension professionals communicate with constituents, and how their communication preferences are impacted by their social identity as science communicators. This chapter is comprised of the results from the three research questions:

Research Question 1: What communication types and channels are used by UI Extension faculty and educators to communicate with constituents?

Research Question 2: How do UI Extension faculty and educators describe their social identities as science communicators?

Research Question 3: What is the relationship between social identity as a science communicator and the communication types and channels used by UI Extension faculty and educators to communicate with their constituents?

Research Question 1: What communication types and channels are used by UI Extension faculty and educators to communicate with constituents?

Participants completed an online confidential Qualtrics survey. The survey included questions regarding how UI Extension faculty and educators communicate with constituents before and during the COVID-19 pandemic regulations, their most preferred channel of communication, their constituents most preferred channels of communication, and what

percentage of their time is spent communicating using mass, group, and individual communication. The survey also included a demographics section. Descriptive statistics were utilized to describe the demographic and career characteristics of survey respondents. Of the 72 respondents, 34 (47.22%) were male, 36 (50%) were female, and 2 (2.78%) preferred not to say (Table 4.1).

Table 4.1

Frequencies and Percentages of Respondent Gender (n = 72)

Gender	*f*	%
Male	34	47.22
Female	36	50.00
Prefer not to say	2	2.78

Most respondents indicated their race was Caucasian (*n* = 65, 90.3%), followed by American Indian or Alaska Native (*n* = 2, 2.9%), Hispanic/Latino and Caucasian (*n* = 1, 1.39%), and Asian (*n* = 1, 1.39%) (Table 4.2).

Table 4.2

Frequencies and Percentages of Respondent Race (n = 69)

Race	*f*	%
Caucasian	65	90.28
American Indian or Alaska Native	2	2.90
Hispanic/Latino & Caucasian	1	1.39
Asian	1	1.39

Note. Three survey participants elected to not complete this question.

There were 10 respondents (13.89%) from the central district, 16 respondents (22.22%) from the eastern district, 20 respondents (27.8%) from the northern district, 11 respondents (15.3%) from the southern district, 11 respondents (15.3%) from a Research and

Extension Center, and 3 respondents (4.2%) from another location. Locations marked other included statewide or campus (Table 4.3).

Table 4.3

Frequencies and Percentages of Respondent District or Location (n = 71)

District or Location	*f*	%
Central	10	13.89
Eastern	16	22.22
Northern	20	27.78
Southern	11	15.28
Research & Extension Center	11	15.28
Other	3	4.17

Note. One respondent chose to not provide their district or location.

Of the respondents 44 were from rural counties (61.17%) and 20 were from urban (27.78%) counties (Table 4.4). Urban counties are those that have one or more urbanized area, 50,000 or more people, or have outlying areas that are economically intertwined with the urbanized area (ERS, 2019). Rural counties are those that do not have an urban area or an economic tie due to workforce (ERS, 2019). Idaho only has six counties classified as urban. Respondents were from 31 counties: Ada, Adams, Bannock, Benewah, Bingham, Blaine, Bonneville, Boundary, Butte, Camas, Canyon, Cassia, Elmore, Franklin, Fremont, Gooding, Idaho, Jefferson, Kootenai, Latah, Lewis, Nez Perce, Owyhee, Power, Twin Falls, Lincoln, Bannock, Madison, Jerome, Caribou, and Teton.

Table 4.4

Frequencies and Percentages of Respondents Located in Urban or Rural Counties (n = 64)

Urban/Rural	*f*	%
Rural	44	61.11
Urban	20	27.78

Note. Eight survey respondents chose not to provide their county.

Table 4.5 displays the respondent's career characteristics. Of the survey respondents, 33 described themselves as being tenured (45.83%), 31 as on track (43.06%), and 7 as ineligible for tenure (9.72%). The rank of the respondents within UI was, 43.06 % Assistant Professor (n = 31), 20.83% Associate Professor (n = 15), 29.17% Professor (n = 21), and 5.56% Senior Instructor (n = 4). Respondents indicated they had a position title of Associate Extension Faculty (n = 9, 12.5%), Clinical Faculty (n = 1, 1.39%), Extension Faculty (n = 44, 61.11%), or Research-Extension Specialist (n = 17, 23.61%).

Table 4.5

Frequencies and Percentages of Respondent Career Characteristics (n = 71)

Demographic Variables	*f*	*%*
Tenure Track		
Tenured	33	45.83
On Track	31	43.06
Ineligible	7	9.72
Rank		
Assistant Professor	31	43.06
Associate Professor	15	20.83
Professor	21	29.17
Senior Instructor	4	5.56
Position Title		
Associate Extension Faculty	9	12.50
Clinical Faculty	1	1.39
Extension Faculty	44	61.11
Research-Extension Specialist	17	23.61

Note. One participant elected to not provide their career characteristics.

Age was used to describe the population using descriptive statistics (Table 4.6). Respondent's age ranged from 25 to 68 with a mean of 47.55 years (SD = 12.07).

Table 4.6

Age of Respondents (n=69)

	Min	*Max*	*M*	*SD*
Age	25	68	47.55	12.07

Note. Three respondents chose not to provide their age.

Time spent working in extension and time spent working in UI Extension was also used to describe the population (Table 4.7). Time working in extension ranged from .5 years to 39 years. The average time working in extension was 12.19 years (*SD* = 10.12). The minimum time working in UI Extension ranged from .5 years to 37 years. The average time working within UI Extension was 10.80 years (*SD* = 12.80).

Table 4.7

Years Worked in Extension and UI Extension (n = 70)

	Min	*Max*	*M*	*SD*
Years Worked in Extension	.5	39	12.19	10.12
Years Worked in UI Extension	.5	37	10.80	12.80

Note. Two respondents elected to not provide their time worked in extension.

Respondents were from 14 program areas: 4-H/youth development; cereals; community development; family finance; farm and ranch management; food safety; forest management; horticulture; human health and nutrition; land and livestock; pests and weeds; potatoes; small farms and food systems; and soil, water, waste, and air management.

Descriptive statistics were utilized to describe UI Extension educators and faculty's personal preference for communication channels (Table 4.8). Respondents ranked the communication channels from 1 to 12, with one being the most preferred and 12 being the least preferred. Walk-ins had an average ranking of 2.25 (*SD* = 1.73) with a range of 1 to 8. Phone call received an average rank of 2.73 (*SD* = 1.50) with a range of 1 to 7. Email

received an average rank of 3.08 (*SD* = 1.66) with a range of 1 to 10. Text had an average ranking of 4.97 (*SD* = 2.33) with a range of 2 to 11. Social media had an average ranking of 5.66 (*SD* = 2.84) with a range of 1 to 12. Online newsletter had an average rank of 6.15 (*SD* = 1.87) with a range of 1 to 10. Website had an average rank of 6.38 (*SD* = 1.93) with a range of 1 to 11. Personal preference for mailed newsletters received an average rank of 7.45 (*SD* = 2.10) with a range of 2 to 12. Personal preference for magazines had an average rank of 8.65 (*SD* = 1.75) with a range of 4 to 12. Radio had an average rank of 9.48 (*SD* = 1.07) and a range of 6 to 11. Television received an average rank of 10.56 (*SD* = 3.22) with a range of 6 to 12. Personal preference for other communication channels received an average rank of 10.56 (*SD* = 3.22) and range of 1 to 12.

Table 4.8

Personal Preference for Communication Channels (n = 71)

Communication Channel	*Min*	*Max*	*M*	*SD*
Social Media	1	12	5.66	2.84
Walk-in	1	8	2.25	1.73
Text	2	11	4.97	2.33
Phone Call	1	7	2.73	1.50
Email	1	10	3.08	1.66
Mailed Newsletter	2	12	7.45	2.10
Online Newsletter	1	10	6.15	1.87
Website	1	11	6.38	1.93
Magazine	4	12	8.65	1.75
Radio	6	11	9.48	1.07
Television	6	12	10.62	1.03
Other	1	12	10.56	3.22

Note. 1 is most preferred, 12 is least preferred. One respondent did not elect to rank their communication preferences.

Descriptive statistics were used to describe how UI Extension faculty and educators ranked their constituents' preference for communication channels (Table 4.9). Walk-in

received an average rank of 2.92 (*SD* = 2.22) with a range of 1 to 9. Email received an average rank of 2.99 (*SD* = 1.48) with a range of 1 to 7. Phone call received an average rank of 3.27 (*SD* = 1.84) with a range of 1 to 9. Social media received an average rank of 4.66 (*SD* 2.67) with a range of 1 to 12. Constituents' preference for text as a communication channel received an average rank of 5.08 (*SD* = 2.60) with a range of 1 to 12. Online newsletter received an average rank of 5.83 (*SD* = 2.06) with a range of 1 to 10. Constituents' preference for mailed newsletter received an average rank of 6.38 (*SD* = 1.95) with a range of 1 to 12. Website received an average rank of 6.39 (*SD* = 2.20) with a range of 1 to 11. Magazine received an average rank of 8.83 (*SD* = 1.51) with a range of 4 to 12. Radio had an average rank of 9.85 (*SD* = .91) and a range of 6 to 11. Constituents' preference for other communication channels received an average rank of 10.62 (*SD* = 3.04) with a range of 1 to 12. Television had an average rank of 10.73 (*SD* = 3.04) with a range of 6 to 12.

Table 4.9

Constituent Preference for Communication Channels (n = 71)

Communication Channel	*Min*	*Max*	*M*	*SD*
Social Media	1	12	4.66	2.67
Walk-in	1	9	2.92	2.22
Text	1	12	5.08	2.60
Phone Call	1	9	3.27	1.84
Email	1	7	2.99	1.48
Mailed Newsletter	1	12	6.83	1.95
Online Newsletter	1	10	5.83	2.06
Website	1	11	6.39	2.20
Magazine	4	12	8.83	1.51
Radio	6	11	9.85	0.91
Television	6	12	10.73	0.99
Other	1	12	10.62	3.04

Note. 1 is most preferred, 12 is least preferred. One respondent did not elect to rank their constituents' communication preferences.

Wilcoxon signed-ranks tests were utilized to compare the respondents' personal communication channel preference with what they indicated as their constituent's preferred communication channel preferences (Table 4.10). Constituent preference for social media was ranked higher than personal preference for social media and the difference was statistically significant (Z = -2.76, p = .01). Personal preference for walk-in was ranked higher than constituent preference for walk-in and the difference was statistically significant (Z = -2.72, p = .02). Personal preference for phone calls were ranked higher than constituent preference for phone calls and the relationship was statistically significant (Z = -2.55, p = .01). Constituent preference for mailed newsletters was ranked higher than personal preference for mailed newsletters and the relationship was statistically significant (Z = -2.37, p = .02). Personal preference for radio as a communication channel was ranked higher than constituent preference for radio as a communication channel and the relationship was statistically significant (Z = -2.56, p = .01). The differences between rankings for personal and constituent preference for text (Z = .31, p = .76), emails (Z = -.24, p = .81), online newsletters (Z = -1.22, p = .22), website (Z = -.69, p = .49), magazines (Z = -1.26, p = .21), television (Z = -.96, p = .56), and other communication channels (Z = -.59, p = .56) were not statistically significant.

Table 4.10

Personal and Constituent Communication Channel Preferences (n = 71)

	Constituent		*Personal*			
	M	*SD*	*M*	*SD*	*Z*	*p*
Social Media	4.66	2.67	5.66	2.84	-2.76	.01*
Walk-in	2.92	2.22	2.25	1.73	-2.72	.02*
Text	5.08	2.60	4.97	2.33	-0.31	.76
Phone Call	3.27	1.84	2.73	1.50	-2.55	.01*
Email	2.99	1.48	3.08	1.66	-0.24	.81
Mailed Newsletter	6.83	1.95	7.45	2.10	-2.37	.02*
Online Newsletter	5.83	2.06	6.15	1.87	-1.22	.22
Website	6.39	2.19	6.38	1.93	-0.69	.49
Magazine	8.83	1.51	8.65	1.75	-1.26	.21
Radio	9.85	0.91	9.48	1.07	-2.56	.01*
Television	10.73	0.99	10.62	1.03	-0.96	.34
Other	10.62	3.04	10.56	3.22	-0.59	.56

Note. Significance at the *p <.05 level, 2-Tailed.

Descriptive statistics were utilized to describe how often respondents used communication channels before COVID-19 and its subsequent restrictions (Table 4.11). Facebook was used as a communication channel never by 23 (31.9%), weekly by 15 (20.8%), monthly by 13 (18.1%), biweekly by 8 (11.1%), daily by 7 (9.7%), and more than daily by 3 (4.2%). Instagram was used as a communication channel never by 55 respondents (76.4%), monthly by 5 (6.9%), daily by 4 (5.6%), weekly by 3 (4.2%), and biweekly by 2 (2.8%). Before COVID Twitter was used as a communication channel never by 61 (84.7%), monthly by 7 (9.7%), and biweekly by 1 (1.4%). YouTube was used as a communication channel never by 42 (58.3%), monthly by 17 (23.6%), weekly by 5 (6.9%), biweekly by 2 (2.8%), more than daily by 2 (2.8%), and daily by 1 (14%). Other social media was used as a communication channel never by 56 respondents (77.8%), monthly by 4 (5.6%), biweekly by 3 (4.2%), weekly by 3 (4.2%), daily by 2 (2.8%), and more than daily by 1 (1.4%). In-person

and walk-in was used as a communication channel before COVID-19 daily by 19 respondents (26.4%), weekly by 18 (25.0%), biweekly by 11 (15.3%), more than daily by 11 (15.3%), and never by 2 (2.8%). Text was used as a communication channel daily by 16 respondents (22.2%), more than daily by 15 (20.8%), never by 12 (16.7%), weekly by 11 (15.3%), biweekly by 8 (11.1%), and monthly by 7 (9.7%). Phone calls were used a communication channel daily by 24 (33.3%), more than daily by 22 (30.6%), weekly by 14 (19.4%), biweekly by 5 (6.9%), monthly by 2 (2.8%), and never by 2 (2.8%). Before COVID, email was used as a communication channel more than daily by 35 respondents (48.6%), daily by 21 (29.2%), weekly by 6 (8.3%), biweekly by 3 (4.2%), monthly by 3 (4.2%), and never by 1 (1.4%). Mailed newsletters were used as communication channels monthly by 38 respondents (52.8%), never by 26 (36.1%), daily by 2 (2.8%), weekly by 2 (2.8%), and biweekly by 1 (1.4%). Websites were used as a communication channel monthly by 29 (40.3%), never by 14 (19.4%), weekly by 11 (15.3%), daily by 8 (11.1%), more than daily by 6 (8.3%), and biweekly by 1 (1.4%). Magazines were used as a communication channel never by 43 (59.7%), monthly by 23 (31.9%), weekly by 2 (2.8%), and biweekly by 1 (1.4%). Radio was used as a communication channel never by 52 respondents (72.2%), monthly by 10 (13.9%), daily by 3 (4.2%), weekly by 2 (2.8%), biweekly by 1 (1.4%), and more than daily by 1 (1.4%). Before COVID-19, television was used as a communication channel never by 65 (90.3%), and daily by 4 (5.6%).

Table 4.11

Communication Channels Before COVID-19 (n = 69)

	1		2		3		4		5		6	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Facebook	23	31.9	13	18.1	8	11.1	15	20.8	7	9.7	3	4.2
Instagram	55	76.4	5	6.9	2	2.8	3	4.2	4	5.6	-	-
Twitter	61	84.7	7	9.7	1	1.4	-	-	-	-	-	-
YouTube	42	58.3	17	23.6	2	2.8	5	6.9	1	1.4	2	2.8
Other SM	56	77.8	4	5.6	3	4.2	3	4.2	2	2.8	1	1.4
Walk-in	2	2.8	11	15.3	8	11.1	18	25	19	26.4	11	15.3
Text	12	16.7	7	9.7	8	11.1	11	15.3	16	22.2	15	20.8
Phone Call	2	2.8	2	2.8	5	6.9	14	19.4	24	33.3	22	30.6
Email	1	1.4	3	4.2	3	4.2	6	8.3	21	29.2	35	48.6
Newsletter-Mail	26	36.1	38	52.8	1	1.4	2	2.8	2	2.8	-	-
Website	14	19.4	29	40.3	1	1.4	11	15.3	8	11.1	6	8.3
Magazine	43	59.7	23	31.9	1	1.4	2	2.8	-	-	-	-
Radio	52	72.2	10	13.9	1	1.4	2	2.8	3	4.2	1	1.4
Television	65	90.3	-	-	-	-	-	-	4	5.6	-	-

Note. 1: Never, 2: Monthly, 3: Biweekly, 4: Weekly, 5: Daily, 6: More than daily. Three respondents elected to not answer their communication channel usage.

Descriptive statistics were also utilized to describe respondents' usage of communication channels during COVID-19 and the subsequent restrictions (Table 4.12). Facebook was never used as a communication channel by 17 respondents (23.6%), weekly by 15 (20.8%), monthly by 14 (19.4%), daily by 12 (16.7%), biweekly by 6 (8.3%), and more than daily by 5 (6.9%). Instagram was used as a communication channel never by 54 (75.0%), monthly by 4 (5.6%), weekly by 4 (5.6%), daily by 4 (5.6%), biweekly by 2 (2.8%), and more than daily by 1 (1.4%). During COVID-19, Twitter was used as a communication channel never by 59 (81.9%), monthly by 6 (8.3%), weekly by 2 (2.8%), biweekly by 1(1.4%), and daily by 1 (1.4%). YouTube was used as a communication channel never by 25 (34.7%), monthly by 26 (36.1%), weekly by 10 (13.9%), daily by 5 (6.9%), more than daily by 2 (2.8%), and biweekly by 1 (1.4%). Other social media was used as communication channels never by 51 (70.8%), monthly by 7 (9.7%), weekly by 7 (9.7%), daily by 2 (2.8%), biweekly by 1(1.4%), and more than daily by 1 (1.4%). During COVID-19, in-person and walk-in was used as a communication channel monthly by 24 respondents (33.3%), never by 19 (26.4%), weekly by 16 (22.2%), biweekly by 7 (9.7%), daily by 2 (2.8%), and more than daily by 1 (1.4%). Texting was used as a communication channel daily by 18 (25.0%), more than daily by 14 (19.4%), weekly by 14 (19.4%), never by 12 (16.7%), monthly by 6 (8.3%), and biweekly by 5 (6.9%). Phone calls were used as communication channels daily by 24 (33.3%), more than daily by 21 (29.2%), weekly by 13 (18.1%), biweekly by 6 (8.3%), monthly by 4 (5.6%), and never by 1 (1.4%). Email was used as a communication channel more than daily by 38 respondents (52.8%), daily by 18 (25.0%), weekly by 6 (8.3%), biweekly by 4 (5.6%), monthly by 2 (2.8%), and never by 1 (1.4%). Mailed newsletters were used as a communication channel monthly by 35 (48.6%), never by 30 (41.7%), weekly by 3

(4.2%), and biweekly by 1 (1.4%). During COVID-19 websites were used as communication channels monthly by 30 (41.7%), never by 10 (13.9%), daily by 9 (12.5%), weekly by 9 (12.5%), biweekly by 6 (8.3%), and more than daily by 5 (6.9%). Magazines were used as communication channels never by 50 (69.4%), monthly by 17 (23.6%), and weekly by 2 (2.8%). Radio was used as a communication channel never by 58 (80.6%), monthly by 7 (9.7%), daily by 2 (2.8%), biweekly by 1 (1.4%), and more than daily by 1 (1.4%). During COVID, television was used as a communication channel never by 65 respondents (90.3%), daily by 3 (4.2%), and more than daily by 1 (1.4%).

Table 4.12

Communication Channels During COVID-19 (n = 69)

	1		2		3		4		5		6	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Facebook	17	23.6	14	19.4	6	8.3	15	20.8	12	16.7	5	6.9
Instagram	54	75.0	4	5.6	2	2.8	4	5.6	4	5.6	1	1.4
Twitter	59	81.9	6	8.3	1	1.4	2	2.8	1	1.4	-	-
YouTube	25	34.7	26	36.1	1	1.4	10	13.9	5	6.9	2	2.8
Other SM	51	70.8	7	9.7	1	1.4	7	9.7	2	2.8	1	1.4
Walk-in	19	26.4	24	33.3	7	9.7	16	22.2	2	2.8	1	1.4
Text	12	16.7	6	8.3	6.9	11.1	14	19.4	18	25	14	19.4
Phone Call	1	1.4	4	5.6	6	8.3	13	18.1	24	33.3	21	29.2
Email	1	1.4	2	2.8	4	5.6	6	8.3	18	25	38	52.8
Newsletter-Mail	30	41.7	35	48.6	1	1.4	3	4.2	-	-	-	-
Website	10	13.9	30		6	8.3	9	12.5	9	12.5	5	6.9
Magazine	50	69.4	17	23.6	-	-	2	2.8	-	-	-	-
Radio	58	80.6	7	9.7	1	1.4	-	-	2	2.8	1	1.4
Television	65	90.3	-	-	-	-	-	-	3	4.2	1	1.4

Note. 1: Never, 2: Monthly, 3: Biweekly, 4: Weekly, 5: Daily, 6: More than daily. Three respondents elected to not answer their communication channel usage.

Wilcoxon signed rank tests were used to compare the communication channels UI Extension faculty and educators used before COVID-19 restrictions and during COVID-19 restrictions (Table 4.13). The usage of Facebook as a communication channel decreased during COVID-19 and the relationship was statistically significant (Z = -4.07, p = .00). The usage of Instagram increased during COVID-19 and the relationship was statistically significant (Z = -2.33, p = .02). The usage of YouTube increased during COVID-19 and the relationship was statistically significant (Z = -4.33, p = .00). In-person and walk-in communication decreased during COVID-19 and the relationship was statistically significant (Z = -6.16, p = .00). Magazine usage as a communication channel decreased during COVID-19 and the relationship was statistically significant (Z = -2.31, p = .02). Utilizing radio as a communication decreased during COVID-19 and the relationship statistically significant (Z = -2.81, p = .01). There was a slight change in Twitter (Z = -1.63, p = .10), other social media (Z = -1.75, p = .08), text (Z = -.81, p = .42), phone calls (Z = -.86, p = .39), email (Z = -.23, p = .82), mailed newsletters (Z = -.89, p = .38), websites (Z = -.33, p = .74), and television (Z = -1.00, p = .32). However, the changes were not statistically significant.

Table 4.13

Before COVID-19 and During COVID-19 Communication Channel Usage (n = 69)

	Before COVID-19		*During COVID-19*			
	M	*SD*	*M*	*SD*	*Z*	*p*
Facebook	2.70	1.58	3.09	1.67	-4.07	.00*
Instagram	1.49	1.13	1.59	1.29	-2.33	.02*
Twitter	1.13	0.38	1.26	0.76	-1.63	.10
YouTube	1.72	1.21	2.28	1.42	-4.33	.00*
Other Social Media	1.46	1.12	1.62	1.24	-1.75	.08
Walk-in	4.07	1.40	2.43	1.28	-6.16	.00*
Text	3.83	1.79	3.90	1.76	-0.81	.42
Phone Call	4.77	1.23	4.71	1.24	-0.86	.39
Email	5.14	1.18	5.20	1.16	-0.23	.82
Mailed Newsletter	1.78	0.86	1.67	0.72	-0.89	.38
Website	2.83	1.63	2.88	1.53	-0.33	.74
Magazine	1.45	0.68	1.33	0.63	-2.31	.02*
Radio	1.51	1.13	1.32	0.95	-2.81	.01*
Television	1.23	0.94	1.25	1.01	-1.00	.32

Note. Significance at the *p <.05 level, 2-tailed. Three respondents elected to not answer their communication channel usage.

Respondents provided what percentage of their time they spent communicating before COVID-19. The average percentage of time spent communicating with constituents before COVID-19 was 28.89% (*SD* = 17.87) hours per typical work week with a range of 0% to 85%. Out of a typical workweek, respondents indicated that they spent an average of 18.35 % (*SD* = 14.81) of their time preparing communication materials, with a range of 0% to 80% (Table 4.14). The average percentage of time spent utilizing individual communication was 36.53% (*SD* = 19.91) with a range of 0% to 80%. The average percentage of time spent communicating through group communication was 39.56% (*SD* = 19.31) with a range of 0% to 80%. Respondents indicated that they spent an average of 14.75% (*SD* = 10.71) of their time communicating through mass communication, with a range of 0% to 50%.

Table 4.14

Percentage of Time Spent Communicating Before COVID (n = 71)

	Min	*Max*	*M*	*SD*
Communicating with Constituents	0	85	28.89	17.87
Preparing Communication Materials	0	80	18.35	14.81
Individual Communication	0	80	36.53	19.91
Group Communication	0	80	39.56	19.31
Mass Communication	0	50	14.75	10.71

Note. One respondent chose to not provide a response.

Respondents provided their time spent communicating during COVID-19. For a typical workweek, they spent an average of 32.25% (*SD* = 21.53) of their time communicating with constituents with a range of 0% to 85%. Out of a typical workweek, respondents indicated that they spend on average 28.39% (*SD* = 19.40) of their time preparing communication materials with a range of 2% to 80% (Table 4.15). Respondents utilized individual communication on average 34.22% (*SD* = 22.75) of the time with a range of 4% to 80%. Group communication was used on average 35.43% (*SD* = 18.15) of the time, with a range of 0% to 80%. The average percentage of time spent communicating through mass communication was 23.40% (*SD* = 19.15) with a range of 0% to 80%.

Table 4.15

Percentage of Time Spent Communicating During COVID (n = 71)

	Min	*Max*	*M*	*SD*
Communicating with constituents	0	85	32.25	21.53
Preparing Communication Materials	2	80	28.39	19.40
Individual Communication	4	80	34.22	22.75
Group Communication	0	80	35.43	18.15
Mass Communication	0	80	23.40	19.15

Note. One respondent chose to not provide a response.

A paired samples t-test was conducted to compare how participants spent their time communication before and during the COVID-19 pandemic and its restrictions (Table 4.16). There was a significant difference in time spent communicating with constituents through mass communication before COVID-19 (M = 14.75, SD = 10.71) and during COVID-19 (M = 23.40, SD = 19.15), $t(71) = -4.3$, $p = .00$. There was also a significant difference in percentage of time spent preparing communication material before COVID-19 (M = 18.35, SD = 14.81) and during COVID-19 (M = 28.39, SD = 19.40), $t(71) = -6.44$, $p = .00$). There was not significant difference in the scores for time spent communicating with constituents before COVID-19 (M = 28.89, SD = 17.87) and time spend communicating with constituents during COVID-19 (M = 32.25, SD = 21.58), $t(71) = -1.92$, $p = .06$. There was not a significant difference in scores for time spent communicating through individual communication before COVID-19 (M = 36.53, SD = 19.91) and during COVID-19 (M = 34.22, SD = 22.75), $t(71) = 1.01$, $p = .316$. There was not significant difference in time spent communicating through group communication before COVID-19 (M = 39.56, SD = 19.31) and during COVID-19 (M = 35.43, SD = 18.15), $t(71) = 1.86$, $p = .067$.

Table 4.16

Differences in Participants' Time Spent Communicating Before and During COVID (n = 71)

	M	*SD*	*t*	*p*
Pair 1				
Before COVID % Spent Comm	28.89	17.87	-1.92	.060
During COVID % Spent Comm	32.25	21.58		
Pair 2				
Before COVID % Preparing Comm	18.35	14.81	-6.44	.000*
During COVID % Preparing Comm	28.39	19.40		
Pair 3				
Before COVID % Indv. Comm	36.53	19.91	1.01	.316
During COVID % Indv. Comm	34.22	22.75		
Pair 4				
Before COVID % Group Comm	39.56	19.31	1.86	.067
During COVID % Group Comm	35.43	18.15		
Pair 5				
Before COVID % Mass Comm	14.75	10.71	-4.30	.000*
During COVID % Mass Comm	23.40	19.15		

Note. Significance at the *p <.05 level, 2-Tailed. Indv. Comm represents Individual Communication.

A Mann-Whitney test and a t-test were utilized to determine any differences between early and late responders. There were no significant differences in responses (Linder et al., 2001).

Research Question 2: How do UI Extension faculty and educators describe their social identities as science communicators?

Respondents to the Qualtrics survey were given the opportunity to provide their contact information and take part in a follow-up interview. The purpose of the interviews aimed to gain insight into how UI Extension faculty and educators identified as science

communicators. Participants were selected through a stratified, purposive sample based upon their most commonly used communication type, district, and location in a rural or urban county. Twelve follow-up interviews were conducted via Zoom. Interviews consisted of 18 pre-chosen questions based upon Longnecker's integrated model of science communication (2016). Age of interview participants ranged from 25 to 68 with an average age of 46.4. Interviews were recorded and transcribed verbatim through Dragon Diction Software. Identifiable information was removed and replaced with pseudonyms. Interviews were open coded by two researchers for common themes and sub-themes. Table 4.17 displays the characteristics of interview participants.

Table 4.17

Characteristics of Interview Participants (n = 12)

Pseudonym	*Comm Type Used*	*Urban/ Rural*	*Gender*	*Years in Extension*
Gladys	Group	Urban	Female	8
Mabel	Group	Urban	Female	23
Howard	Ind. & Group	Rural	Male	6
Beatrice	Group	Urban	Female	25
Albert	Group	Rural	Male	7
Sue	Group	Rural	Female	3
Elmer	Individual	Urban	Male	8
Ester	Group	Rural	Female	29
Shirley	Individual	Urban	Female	3
Ernest	Individual	Urban	Male	4
Florence	Group & Mass	Rural	Female	7
Frank	Mass	Rural	male	5

Five common themes were identified during open coding: continual development, technology, research dissemination, evaluation & motivation, and community relationships. These themes were commonly discussed in a multitude of ways during the interviews. These common themes also had significant appearances and contributions to the eight components

of Longnecker's (2016) integrated model of science communication from which the interview protocol was developed.

Continual Development

Participants discussed the importance of professional development, learning about new technology, association with professional organizations, and the need to continue to grow as science communicators, UI Extension faculty, and educators. Ernest said he believes that continual development is part of his job:

> I think as an educator, it's my job to look for ways to continue to improve my communication skills and continue to look for ways to reach new audiences. And not just be comfortable with, my comfort zone… I need to continue to improve and become better.

Sue noted that learning should never stop, "I view it as a continual process, like I think we can never stop learning and I think a lot of times mentors can serve as great resources for that too."

The utilization of mentors and those around them to assist in continued development was discussed. Elmer said, "I just try to learn from other experienced educators and science communicators." Some individuals described teamwork and connecting with others throughout the state as an area they would like to improve themselves and see change within their program area. A few respondents were not aware science communication training is its own area. Frank admitted, "I didn't know that was like a whole genre of the workshops or training." While Ernest stated he has had other types of communication training, but not specifically science communication training, "I don't think that I have officially had science… I've had communication training, I've had how to present training, I've had

general communication training, but nothing specific to science." Sue stated that she would be interested in further training such as, "how to effectively advocate in agriculture or communicate in agriculture. I would be interested in a conference like that or even a class." Meanwhile, Albert noted his personal experiences have helped him, "I myself have learned by doing." Howard indicated science communication is an area he could improve, "I need to be a better communicator… I worked in private industry for quite a while and it's been a real change coming to the extension side, working with people that way."

Respondents also discussed the importance for those with experience outside of extension or science communication to gain new skills and combine them with their other experiences or knowledge in order to become more effective communicators of science. Albert said, "It's important to recognize that everyone has a different skill set, no matter what your academic level of achievement is." When asked about further science communication training, Ernest said:

> I feel like that's something that is really needed… people that don't know how to tell the story about what the heck they're doing in their research. I think researchers have a hard time with that sometimes. Like they're so invested in what their research is that it can't articulate without using the technical language or the jargon surrounding it.

Beatrice said, "I think a lot of people that teach science-based material start out with a science degree and end up trying to teach it, so it does help to have some education training." Beatrice also said because her background is science based, she has continued to expand her skills in teaching and communication, "I also did not have formal teaching training because I was a science person. But I do try to take some professional development in basic educational principles. This is not my area of expertise."

Increasing skills within social media and technology was included in the discussion of how respondents wanted to continue to learn and grow. Increasing skills with technology would provide them a channel to appeal towards and interest more people. Elmer stated:

> I'd like to know more about how to get… visually get the message out. How to make brochures, how to make videos, to make posters. How do you grab people's attention? How do you make a really dynamite presentation, even if you have to rely on a bunch of slides?

Participants also discussed utilizing professional development opportunities through their jobs and professional organizations as a way to continue to develop their skills. Gladys said, "we have professional development every year and so I think there's always something we pick up from our national conferences… just helping us communicate." Furthermore, Sue afforded a lot of credit to professional development, "those professional development opportunities. Those are the ones that mostly have got me to this point." Beatrice said professional associations have helped her to develop her science communication skills, "I network with a couple national associations and we do cover a lot of that in our own group that's specific to our field of study." Mabel said her involvement with professional associations are influential on her career and her skills, "I think it's really important to be involved with your professional organizations… Not only our Idaho Association for Extension [program name], with a national association. Which I have been officers in both, served in both."

In the eight factors of Longnecker's (2016) integrated model of science communication, identity construct, continual development was discussed frequently. In the understanding factor, individuals noted the importance of being a science communicator, but

continuing to adapt. In the awareness factor, some individuals had resources that assisted them in reaching new people and developing skills. Continual development was routinely discussed in the behavior factor. Individuals noted what background they had in science communication, while expanding on new skills, platforms, technology, and connections they could make to increase their communication skills. In the attitudes factor, individuals indicated they believed they became more reliable and better assets when they continued to grow and increase their skills.

Technology

The concept of technology and its impact on science communication was discussed frequently throughout the interviews. Individuals also noted the barriers there are with technology, how it has assisted in reaching new audiences, and what they personally want to improve on. Individuals discussed what impact they think COVID-19 and utilizing new technology through its subsequent restrictions will have on the future of program delivery. Howard noted the usage of Zoom meetings for conferences, and said, "I don't know if we will actually every go back to the total in-conference meetings. They like to save the expenses, save them time." Frank said, "I don't know what after the pandemic is lifted about how this is to go forward, will probably end up with some kind of a hybrid."

Interviewees discussed how technology helped them to communicate and deliver content during the COVID-19 pandemic and the subsequent restrictions. Beatrice said, "Because of COVID we've gone to online training, and surprisingly, our clientele have really embraced it. So, we've been fairly successful with online education." Frank noted he has been able to reach more people, "lately it's been a lot over the computer which has allowed us to reach a lot more people, I feel like people who wouldn't join otherwise." Gladys

commented her program has been adapting to provide a mixture of programming, “Last year we did a lot of synchronous and asynchronous programming. So, we have a lot of videos that we did and a lot of online workshops. So, I think we can do pretty, like, big mixture of stuff.” Albert discussed how utilizing technology during the COVID-19 pandemic has taught him a lot, “one of the thing last year has taught us is that we all need to be much more effective communicators on an online platform.”

Technology was discussed as a barrier to some UI Extension educators and faculty, specifically due to the reliance on technology with the COVID-19 pandemic. Sue said that COVID-19 has caused difficulties, “that has been a challenge to navigate just because when all our programs online, it kinda limited the access that some folks had to those programs. So technology in general is a big one.” Gladys noted, “some people don’t have smart phones either, so that can be an issue.” It was also discussed as a barrier for rural Idaho residents and rural county constituents. Sue said, “Zoom has been challenging for some of our group because there’s not great rural broadband access to all parts of Idaho, there’s not great cellular access to all parts of Idaho.” Shirley shared that her office has a way to help people overcome the technology barrier, “I think the only thing would be if people don’t have internet because everything’s on the internet. But we provide computers in our office.” Technology has also been a barrier to UI Extension educators and faculty. Howard said:

> Now everybody gets on zoom and you look out there and everybody just puts it on mute, cancels out the video, so you’re just talking to a bunch of numbers. So, there’s no interaction. For me, it has been really hard because, in a room, you can communicate with them, you can tell if people are interested in what you are doing. It’s really hard sometimes just talking to a screen.

Respondents also discussed technology as a way to reach specific audiences depending on their demographics or needs. Mabel said:

> Different groups have different needs. There are groups I work with that it's good just to email or zoom meetings or whatever. And then there's others, you just, you have to reach out with a phone call, or text, or something else.

Frank noted, "so it's a different audience that's willing to get on a Zoom meeting than is willing to come into a workshop or class." Respondents indicated technology has been beneficial, but it is important to not leave behind those constituents who do not use technology as much. Florence said:

> I didn't actually realize that there was a value to that component of my job and that it was actually really critical and important to not leaving communities behind. But through some reflection on the meaning of my work, and the meaningfulness of my work, I think digital inclusion is also something that all extension educators do, but maybe don't recognize or give themselves credit for the necessary and meaningful impact that can have on communities.

Sue said, "There is a significant generation group that still prefers phone calls, and so utilizing those phone calls."

Technology was discussed as an area with significant potential for personal and professional growth and to help increase their reach. Ester said, "I'm always on the lookout. Okay, how do we do this better, try new things. Especially with going via Zoom, figuring out polls to get people engaged." Albert had many ideas on how to increase his knowledge and skills with technology:

> Learning more about how to use social media platforms more efficiently. I think there's a lot of room for, trying to draw people's attention to fieldwork or experiments that may be running to try to capture attention that is currently being focused on. I don't think we need to wait for two year until a paper's published in order to bring people's attention to the topic.

Ernest also had ideas for how to increase his skills:

> I want to be trained on how to be a better storyteller of different topics. You know whether that, hey there is this awesome science curriculum, we're doing embryology, you know, and how a chicken develops and I want to be able to take that, and I want to learn how to make a thirty second video that can go on Instagram, Facebook, or TikTok.

Technology aided in the impact that those working for UI Extension could have as science communicators. Individuals discussed technology throughout many components of the interview. In the understanding factor, they indicated that part of being a science communicator was having the means to disseminate that information. Technology was discussed in-depth in the awareness factor. UI Extension educators and faculty utilize technology as a major resource before and during COVID. However, technology can also be a barrier to many. Technology was discussed under the skills factor. Technology acted as a method of communication, and respondents identified that different audiences are more receptive to different types of technology. Technology can also aide in the evaluation of communication materials. Lastly, technology was included in the attitude factor. Technology can help to increase their impact as science communicators.

Research Dissemination

The theme of research dissemination was a multi-faceted concept commonly brought up during the interviews. Within this theme there was discussion of being a hub for information, framing information, how to present information, and barriers. This theme also included discussion of where information should come from and how to be reliable sources.

The concept of UI Extension faculty and educators being a channel or source where constituents can receive science-based information was discussed heavily. Shirley said, "The U of I is doing all this research, and then there is the public who needs the information. So, our job is to connect those two by getting the information out to them in each county." Frank echoed, "a lot of times I like to think of extension faculty or extension educators as an information broker, right. So, I don't have all of the answers, but I know someone who will." Florence said, "So it's all interwoven and I plug-in where I can be an expert, and find experts where I don't know, and don't have content knowledge." Presenting information in a way that is digestible for constituents was discussed as well. Beatrice commented, "I think our role is to take all that science speak, if you will, and turn it into lay speak so that it's very useful and understandable to people." Sue added:

> I see myself as a science communicator in the aspect that I have sought out higher education so that I can learn at a higher level or at a different level, a more in-depth level so that I can be a voice of an industry that I am passionate about.

Shirley said having validation of source reliability is important:

> But also include the resources that I used to get that information so that if they have further questions or if I didn't portray something in a way that they understood, they have the information and where I got it from.

Individuals noted how it is their job as a UI Extension faculty or educators to disseminate research to the communities around them. They indicated they rely heavily on information based upon research from UI and other land grant universities. Albert said, "I'm not afraid at all to go to other land grant universities, Purdue, Ohio State, or University of Nebraska to try and find other information and bring that in." Gladys had a similar statement, "I don't take information from anywhere else, unless it is a land-grant university." Collaboration was also discussed as a way to increase the flow of information. Sue said, "we can sometimes work in silos, and to be effective and to help communities grow and do things that you may be researching, you need to get that information out to the right people." Personal experiences or background contributed to making participants more trustworthy sources. Frank said, "personally I like to stay involved with research. One because it gives me that relevance, and I also get a little more street cred." Individuals also discussed how actually disseminating the information you have is vital. Mabel commented, "It's doing something with the research. It doesn't do any good to do the science, do the experiments, unless its gonna go somewhere."

There were significant values the participants noted they try to uphold when disseminating information to their constituents. Albert discussed how success in his field is reliant on credibility:

> So you have to be consistent about admitting your shortcoming, not highlighting them. But they'll remember bravado, braggadocio, that unfounded and that's quick offramp to trust. So slow, methodical consistent tortoise and the hare, being the tortoise, is how I think you succeed in that aspect of this field.

Many individuals noted the importance of making sure the information presented is fact, not opinion. Beatrice said, "I try to keep my opinion out of it, or I try to just make sure that the information is factual and is referenced." Shirley had a similar outlook, "My responsibility when communicating with the public is making sure that I'm giving out research-based information that is honest and true and up-to-date." Once trust was established with constituents, the importance of keeping trust was noted. Albert stated, "maintaining our credibility is to be seen as a trusted resource, we are a resource. But we have to be very careful not be seen as a nefarious actor within that trust." Ernest's outlook was, "personally that's something I try to do as well, is maintain a positive attitude and talk up how we're an amazing program."

Respondents also indicated there were barriers and difficulties to disseminating information; particularly when trying to communicate information to individuals who are stuck in their ways or not open to hearing new information. Shirley said that aspect is her least favorite part of her job:

> My least favorite part is probably people who are very much sticklers, and they're like, "my grandma told me this before she died" and it's like, okay, well research actually shows that that doesn't actually do anything, but this works.

Lastly, making connections and maintaining relationships with those around them was acknowledged as a significant aspect of the disseminating theme. Having a relationship with stakeholders can help in the process of research dissemination, Frank said, "we expect to hear from stakeholders and then once we figure out what's going on with stakeholder, we try to get it out through various methods." However, relationships can also be contentious. Albert noted:

> I think that the general public sees us sometimes as gatekeepers for… there's a lot of mistrust. Especially when we're talking about new approaches or new ways to handle old issues. They may look to us to see how we really seem to be approaching this or feel about it.

Within the identity construct of Longnecker's (2016) integrated model of science communication, dissemination of information was discussed in many of the interviews. In the understanding factor, dissemination of information was discussed heavily as a science communicator's role. Also, encompassed in this factor was the personal role of a science communicator to disseminate research to their constituents. Many individuals also discussed research dissemination within the affect factor. They indicated seeing those around them be able to access and put to use the information provides as a motivation for them. There were many values associated with disseminating research, such as being reliable and trustworthy. Furthermore, they believed themselves and others that identified as science communicators played a key role in science communication. Within the skills factor, individuals discussed how it is their job to provide the information to their constituents in a way that is easily understood and usable. The theme of research dissemination was also discussed under the attitudes factor. Respondents noted they can make a significant impact if they fulfill their role of disseminating information. This also included being a reliable source of the information. Lastly, within the beliefs factor, individuals noted that themselves and other science communicators played a key role in discussing scientific information with the public.

Evaluation and Motivation

Participants described the need for evaluations, formal and informal. They then included the need to learn from the evaluations to adapt their communication to have a

greater impact. Personal motivation for impacting their communities was also discussed in this theme.

Formal and informal evaluations were a major component of evaluating effectiveness of communication or programming. Participants stated information found during these evaluations can help to provide a pathway to make programming more effective. Frank said, "in extension, we need to have feedback from them so that we know what's happening out there and so there's not a disconnect between the scientific community, the clientele, and the stakeholders out in the state of Idaho." Elmer indicated evaluating and delivering to community needs is vital, "that's my responsibility… is to develop and deliver these programs based on what people need, based on the identified need." Florence stated:

> With teaching oftentimes it's very hard to evaluate your impact and so you can access knowledge gained. But knowledge retained and behavior change, those are different things to monitor and they're more long-term and there's a lot of different factors that influence it.

Mabel discussed the importance of actually knowing what the audience needs from you, "So the needs of that group and the only way you know that is to have some kind of initial communication with them, first of all. So, you can honestly evaluate what they do need from you." If the audience does not indicate their needs, it is vital that their needs are uncovered rapidly. "You have to know, kind of, where they're coming from. That goes all the way back, you know, know your audience. If you don't know them, read them quickly," Elmer.

Respondents also discussed how they can impact their communities and what motivates them to do so. Albert noted, "It's all about impact in extension, impacts and outcome, right?" Elmer shared he relies on theory as a foundation for his communication, "I

try to draw on both teaching strictly teaching education theory, as well as the area of psychology. That is where communication is rooted." Ernest noted that having impactful programming is important to him:

> So, in my role, I see myself as needing to provide those experiences that will stick in their mind. Because I could teach, stand and do a PowerPoint, and just go through slides, and that would be delivering information. But what impact does that have? Will there be any memory attached to it?

Shirley said her passion for what she does provides motivation, "I have my own passion and teaching about [program area], so when there are things that I am passionate about learning, I want to make sure that others are getting the information that I'm learning as well." Elmer also had a similar view, "so it comes from a deep-seated love of the topic, of the subject."

The evaluation and motivation theme was revealed in multiple places during the interviews. In the understanding factor, individuals mentioned that science communicators have passion and want to make an impact. Similarly, the affect factor included conversations about their motivation as science communicators to benefit their communities based upon their needs. This theme was also discussed during the values factor. Individuals discussed how their responsibilities as science communicators and UI Extension professionals lead them to continually providing programming to their communities based upon their needs. The skills factor included discussion on how different audiences need different things, and it is necessary for UI Extension professionals to evaluate and deliver targeted material. It was also discussed in-depth under the skill factor when asked about how they evaluate the effectiveness of their communication. Evaluation and motivation of their work was included in the attitudes portion. Respondents indicated they have an opportunity to make positive

impacts in their community and science fields. Lastly, evaluation and motivation was discussed during the beliefs factor. Many believed communicating that information to their communities is a valued part of their job and position.

Community Relationships

UI Extension faculty and educators identified themselves as being assets to their communities and established how strong relationships areas that they work are critical. Furthermore, maintaining positive relationships with people on a personal level can increase the impact and reach of extension and their work. The concept of relationships in the community was discussed in this theme. This includes what extension's role is in their communities and how being part of the community has benefits and barriers. An extension professionals' ability to develop relationships with those around them contributed to an increased capacity to fix problems and help constituents improve their operations or otherwise positively impact their lives.

Personal relationships were a topic discussed in-depth in this theme. Specifically, the importance of forming connections and relationships and how to maintain the relationships was a topic of particular interest. Participants said being personable and caring can aide in building relationships. Ester said:

> People need to know you care before they care how much you know. And as I meet clientele as I got started in this community, I tried to learn a little bit about each person and asked you know… 'okay how are the grandkids doing, I heard Jake broke his arm, and that…' they knew I really cared and listened.

Many individuals said having common ground with constituents can also aid in building relationships and establishing trust. Shirley stated, "I try to be personable. Like, that's

important to me. I want people to know I'm a real person, just the 'here's the information I know', so I definitely try and use personal examples." Some respondents indicated not all relationships or credibility are built overnight. Albert noted, "I think that time and being seen over time and slowly building a reputation as being trustworthy actors is how it's done in this field." Several respondents noted relationships are built in order to boost success. Ernest said, "I would say a majority of my job, though, is that relationship building to make sure that things get done." Furthermore, Shirley shared:

> I think the greatest impact is that the more you communicate with people, the more your name gets out there, and so people will recognize when things come out, will be more willing to come to programs like, "oh I know her, I've heard of her." That helps.

Personal relationships includes connecting with those who have different worldviews. Florence stated, "just because we might have some foundational differences in belief, I can't look down at that person as being any less educated or less valued as a societal contributing member."

Participants recognized an aspect of building connections and relationships comes responsibilities for maintaining them. Albert noted:

> In a lot of ways, we get access to people's lives and operations that other professionals may not get access to. And that is… there's trust involved with that, and we need to be very careful about maintaining that trust.

Respondents also emphasized the importance of understanding boundaries on relationships. Florence said, "It is importance to recognize where I do have influence and where I don't. It is important that I'm not judging and never severing those relationships that are so critical to

extension work." Further, Shirley added that avoiding controversial topics is vital to maintain the relationships that are built:

> I don't like to talk about like religion or politics or those things because I don't feel like they affect how things should be accomplished. So, if this is how it should be done and it work. I don't think the politics or religion have anything to do with that.

Being part of a community and having those connections can be beneficial for UI According to Albert, "we help to draw focus to issues and maybe elevate those issues to a level of importance that the general public doesn't seem them at." However, Florence noted sometimes external support is needed to support individuals who live and work in the same community. She said, "the ability to connect those communities to external experts, and that voice is sometimes heard louder than our own local voice. So, leading from the middle is important." Meanwhile, some individuals did not identify themselves as science communicators within their communities. Howard shared:

> I don't know if I do a lot of science. I know the people to get to be able to communicate. So I kind of relate, uh, just tie the people in with the people that really know the science. I am more of kind of a coordinator to be honest.

Furthermore, the concept of working together to reach more individuals was discussed. Sue said, "I just find that we don't all have the same skill levels right, or the same passions and so that if we can work together and disseminate information so that everybody has equal opportunity to learn the same things."

Participants noted that there is personal motivation and pride associated with community relationships. "People live in the communities they work in. So I think there's

some pride and personal pride" (Beatrice). The motivation for impacting others and their community was discussed. Ernest said:

> I see it as my job to empower others to go out there and be science communicators because I am only one guy. But I can train over a hundred people… like I have over a hundred volunteers to go out and teach kids and science concepts.

Individuals did recognize barriers within their community relationships. Albert noted, "You know what's the most challenging? Sometimes it feels like we're shouting in the dark. Especially over the last year." Similarly, Ester said, "What I don't like is when somebody just is, their feet are poured in concrete and they won't listen to reason."

Participants discussed how community relationships can lead to deep impact and problem solving. Individuals discussed how it is important to understand their constituent's problems. Ester shared "it's me taking the time to truly listen and trying to understand my client situation and then give them the best information they have to make the decision that is best for them." Similarly, Shirley said:

> I want to speak with them. I feel like if they are more comfortable talking back and forth, then I can figure out exactly what their problems are, instead of going "this is everyone's problem, and this is how you fix it." Because it's not everyone's problem.

Furthermore, individuals discussed how the reach of their work within communities can be further than helping solve their concrete problems. Sue said:

> I think as extension educators, we want to see a change, we want to see a difference, make a difference. And so that communication that we give out to the general public is our way of helping our little communities or big communities.

Florence had a similar understanding of how wide her impact could be:

> Civic engagement is critical and knowing that I can help mobilize leadership and people to envision the future they want. There is power in coming together and the result can be resources such as money or technical support. These can fall out of the sky, all because people decided to show up in one place.

Within the identity construct in Longnecker's (2016) integrated model of science communication, the theme of community relationships was discussed under many factors. In the understanding factor, individuals discussed how their role as a science communicator was to have relationships with their constituents and communities to enable the transfer of information. In the affect factor, respondents indicated that they were motivated to communicate in their communities because of their relationships and the impact that they can have. Community relationships were discussed in the values factor; respondents said they had responsibilities in connecting and maintaining relationships that can help them to fulfill their job requirements as UI Extension educators and faculty. There were corresponding principles and values. In the skills factor, respondents identified that different individuals within their communities had different needs. Therefore, it was important to establish relationships in order to fully understand the needs, and then provide information and resources. Within the attitudes factor, respondents discussed how they must establish relationships by being trustworthy sources in order to fulfill their roles and impact their community. Lastly, respondents discussed community relationships in the beliefs factor. They indicated that discussing information and research in their communities was important to them.

Research Question 3: What is the relationship between social identity as a science communicator and the communication types and channels used by UI Extension faculty and educators to communicate with their constituents?

The data collected from the survey and interviews were mixed to find what influence the communication type most commonly used by the UI Extension faculty and educators had on their views on science communication identity. Common themes emerging from the interviews were: evaluation and impact, continual development, technology, community relationships, and research dissemination. The responses from these themes were compared based on the three communication types self-identified by participants: individual, group, and mass.

Table 4.18

Comparison of Emergent Themes to Communication Type Most Commonly Used

	Communication Type Most Commonly Used		
Themes	Individual	Group	Mass
Continual Development	No significant influence	No significant influence	No significant influence
Technology	Technology provides an opportunity for expansion	Technology has provided barriers, but provides room for growth	Insignificant data
Research Dissemination	Utilizing UI and land-grant university resources	Acting as a reliable source to disseminate research-based information	Connecting constituents to experts
Evaluation & Motivation	Visual observations and understanding	Evaluation for community impact and needs	Data and evidence for impact
Community Relationships	Personable connections and collaboration	Relationships provide opportunities	Insignificant data

Note. No significant influence indicates that patterns based on communication type were not identified. Data was considered insignificant if less than 60% of the interviewees from the communication type were not represented.

Continual Development and Communication Type

There was no significant relationship between continual development and communication types. Individuals throughout all three groups noted the importance of continual education. They included involvement with professional associations and participating in professional development to be steps they have taken in furthering their skills

throughout their careers. Individuals in all three communication types also identified as an opportunity for continued growth.

Technology and Communication Type

Respondents who most commonly used individual communication discussed that technology has been beneficial in programming throughout the last year. However, this group of individuals recognized technology as an area for an expansion for extension and themselves. They indicated there is a major opportunity to grow their skills to help to increase the reach and visibility of extension programming.

Respondents who most commonly used group communication indicated that while they have adapted to in an increase in technology usage during COVID-19, it proved to be a barrier for some of their constituents and the delivery of information. They indicated a recognition for the importance of technology in the delivery of the content, but also saw an opportunity for themselves to be more tech savvy and increase their skills.

There was not enough information provided in the technology theme from those who commonly utilize mass communication to make reliable associations. However, it is worth noting that the individual who utilizes mass communication the most discussed their usage and positive association with technology before COVID-19 and how their usage has increased and reached new people during COVID-19. They indicated that the transition to online programming was fairly smooth because of their constituents and personal usage and knowledge prior to the pandemic.

Research Dissemination and Communication Type

Respondents who utilize individual communication type the most emphasized the importance of research-based information coming from UI or other land-grant universities.

They use their backgrounds or ties to UI to help emphasize their reliability. This group of individuals highlighted how they act as both sources to disseminate information and teachers of that information. This includes making sure the information is presented in a way that is easily understandable, while verifying that the information is helpful and understood.

Respondents who utilize group communication the most also emphasized the importance of research-based information. However, these individuals continually discussed having the responsibility of being seen as a reliable and trustworthy source. Their main role was to disseminate information to their constituents; however, they noted that it was vital to continually be backed up by credible sources. They discussed their role as being the one to find the information and communicate it to their constituents.

Individuals who utilize mass communication discussed the need and benefit of directly connecting individuals to other content experts to help answer their problems. They noted that while their role was to provide information, sometimes connecting their constituents to an individual or bringing an individual into the community was impactful. This included collaboration with others, where they present their current research and findings for others, instead of individuals having to seek that information out on their own.

Evaluation & Motivation and Communication Type

Respondents who most commonly used individual communication discussed the usage of formal surveys and evaluations the least. Instead, these individuals emphasized asking constituents follow-up questions, checking for understanding, as well as visual observations. These individuals addressed how programming and activities can have long-term impacts on constituents, whether through hands-on activities or the provision of visually appealing presentations and videos. Participants expressed the value of making sure their

programming and communication is understood and bears relevance with the needs of the constituents. These individuals disclosed how seeing their constituents grasp topics was motivational and important to them. Education philosophy and models were mentioned briefly as foundations for programming. These interviewees also referenced the importance of understanding their audience and delivering programming specifically for them.

Respondents who most frequently used group communication noted the usage of formal and informal evaluations. This body of respondents emphasized the usage of those evaluations as tools to tailor their communication and programs to fit the community needs. Evaluations included informal and formal surveys, needs assessments, and conversations with community members. Participants who most commonly used group communication conveyed it is helpful when the constituents make the first initial connection. They described being able to more effectively help their constituents when they knew exactly what the need was. Interviewees indicated they had a passion for their topic area and that helped them to continue to develop programming.

Respondents who most frequently used mass communication included the importance of surveys and collecting data. The surveys discussed were to check for understanding and provide data to represent an impact of the programming or information provided to constituents, such as increased crop yields or attendance at meetings. Specifically, surveying people about content they were taught previously to understand the impact of their communication.

Community Relationships and Communication Type

Individuals who utilized individual communication emphasized the importance of relationship building leading to collaboration and assistance in disseminating information.

Individuals in this group discussed their appreciation for involvement and communication in the community, such as having meaningful personal relationships and impact. These individuals noted being personable and reachable in their communities as essential attributes of extension professionals.

Individuals who utilized group communication most often identified that relationships are important to help develop trust. They discussed the role of the relationships they establish in their communities as a means to increase the reach of their programming. They shared about the impact that they can make in their communities as motivating and that communication and relationships are a two-way street. They also noted that it is important for extension faculty and educators to understand each other.

Those who communicated through mass communication the most did not have enough similarities in responses to determine an influence. One respondent emphasized the importance of pushing communities to be more open-minded and inclusive. While discussing the concept of personal relationships, it was noted that personal relationships are important in the community that you work, but they can be contentious. The other respondent discussed how their personal motivation and interests impact their relationships and how they provide information to constituents.

Summary

UI Extension faculty and educators use many communication types and channels to communicate with constituents. Those types and channels have changed during the COVID-19 pandemic and restrictions. Interviews with 12 UI Extension faculty and educators gave insight into their views on science communication identity. These interviews provided 5 common themes: continual development, technology, research dissemination, evaluation and

motivation, and community relationships. Finally, the mixing of the quantitative and qualitative data gave an insight into how communication type preference influences individual's views on their science communicator identity. There are differences found in technology, research dissemination, evaluation and motivation, and community relationships.

Chapter 5: Discussion and Conclusion

The purpose of this study was to explore how UI Extension faculty and educators identify as science communicators and what relationships exist between preferred communication type and their science communicator identity. By understanding how UI Extension faculty and educators communicate with their constituents, opportunities for expansion and change can be identified to help meet the needs of the changing constituents. Researching how UI Extension faculty and educators view their social identity as a science communicator can help us understand what they view their role is in disseminating information to their constituents. It can also help to understand ways to improve the communication channels between extension faculty and educators and constituents. Lastly, understanding the relationship between an individual's preferred communication type and how they view their social identity as a science communicator can lead to a better understanding of how to effectively communicate with specific audiences, and where new communication training and techniques are needed to bridge communication gaps. This chapter contains discussions of the three research questions, conclusions, recommendations for practice, and recommendations for further research.

Discussion

Research Question 1: What communication types and channels are used by UI Extension faculty and educators to communicate with constituents?

Respondents to the survey were prompted to rank their most preferred communication channel and their constituents most preferred communication channel. They indicated that their preferred communication channel was walk-in and in-person, followed by

phone calls. Most of the highest ranked communication channels would be classified as individual communication. One of the highly ranked communication channels falls under group communication. This finding was consistent with what communication type UI Extension faculty and educators use to communicate the most. Individual communication provides an opportunity for messages to be specifically tailored to the individual and their needs (Jenkins et al., 2020). This finding also aligns with previous research indicating constituents preferred individual communication because it seems more reliable and the messages are personally tailored to their specific needs (Licht & Martin, 2007).

Social media accrued an average rank of 5.66 with a relatively high standard deviation of 2.84 and a range of 1 to 12. Indicating that personal preference for social media varied greatly. Respondents noted their constituents prefer walk-in and in-person ($M = 2.92$), followed by email ($M = 2.99$), and then phone calls ($M = 3.27$). Constituent preference for social media also fell in the middle but received ranks of 1 through 12 and had a relatively high standard deviation of 2.67. This also indicates preferences for social media varied greatly between respondents. Individual preference for social media, and other communication channels varied greatly. The variance may be attributed to how specific demographic and background information has impact on communication preferences (Agunda, 1998). Understanding demographic and background information and tailoring communication is vital for effectively disseminating information.

The results from the Wilcoxon Signed-Ranks Test indicated personal and constituents' preferences for communication channels are closely related. Social media ($p = .01$), walk-in ($p = .02$), phone calls ($p = .01$), mailed newsletters ($p = .02$), and radio ($p = .01$) had statistically significant differences. Respondents ranked their personal preference for

walk-in (M = 2.25) and phone calls (M = 2.73) higher than constituents' preference for walk-in (M = 2.92) and phone calls (M = 3.27). Many individuals in the qualitative portion of the study stated their appreciation for personal connection when communicating with constituents. As extension was founded rural needs and traditions fostering more personal forms of communication (Henning et al., 2014). This finding of respondents exuding a more acute preference for personal communication may give a nod to the roots of the program. This lack of alignment can cause communication gaps. Understanding the audience's needs, preferences for communication, and access to resources is important to avoid inefficient communication. Once the audience's needs are understood, the concepts of framing theory can be applied to specifically target information to the constituents. This concept can help increase the likelihood of acceptance and utilization (Dameen et al., 2001). For example, in rural areas with lacking technology infrastructure an extension professional should try to use traditional communication types like mailed letters and in-person communication and not rely on technology.

The results from the Wilcoxon Signed-Ranks Tests indicated UI Extension educators and faculty have agreeance in some of their preferred communication channels. For instance, the preferences for emails were not statistically significant. This shows UI Extension educators and faculty's preference for emails (M = 3.08) and their constituent's preference for email (M = 2.99) aligns and can be an effective and accepted form of communication for both constituents and extension educators and faculty. However, there are communication gaps that can exist due to the differences in preference. UI Extension educators and faculty can utilize audience segmentation to better serve their constituents and aid in the dissemination of research-based information (Lamm et al., 2019).

The COVID-19 pandemic had an impact on how UI Extension educators and faculty communicated with their constituents. Extension was required to rapidly respond and acclimate to COVID-19 regulations. The ability of extension to adapt is reliant upon extension educators and faculty to adjust with the changing times (Narine & Meier, 2020). UI Extension educators and faculty reportedly were able to change and adapt their communication tendencies to account for regulations and requirements while still maintaining the cyclical nature of extension communication. Emails, phone calls, and walk-ins were utilized by most individuals weekly and in some cases daily. During COVID-19, there was a statistically significant decrease in walk-ins ($M = 2.43$), compared to before COVID-19 ($M = 4.07$). This was expected due to regulations.

The usage of Facebook, Instagram, and YouTube increased during COVID-19. UI Extension educators and faculty had to find new ways to communicate with constituents. This aligns with what would be expected due to regulations and shutdowns of in-person activities and businesses.

Overall, respondents indicated they spent approximately the same amount of time before and during the COVID-19 pandemic communicating with constituents, utilizing individual communication, and utilizing group communication. Before COVID-19, UI Extension faculty and educators spent an average of 28.89% of their time communicating with constituents. During COVID-19, this increased to 32.25% of their time. Before COVID-19, 18.35% of their time was spent preparing communication materials. During COVID-19, this increased to 28.39% of their time. This data aligns with previous research depicting extension professionals perceive one of their main roles as communicating with constituents

and providing them information that is relevant to their needs and problems (Donnellan & Montgomery, 2005).

UI Extension educators and faculty usage of mass communication increased significantly during COVID-19. Before COVID-19, average time spent using mass communication was 14.75%, and during COVID-19 the average time was 23.40%. Furthermore, they noted they spent more time preparing communication materials during COVID-19 (28.39%) than they did before (18.35%). This aligns with what would be expected due to regulations and utilization of mass communication sources to disseminate information to people. Mass communication is an effective type of communication to disseminate information to large quantities of people at the same time (Telg & Irani, 2012). Due to COVID-19 regulations, in-person and individual communication lessened, and UI Extension educators and faculty accommodated by utilizing the efficiency and extended reach of mass communication.

Research Question 2: How do UI Extension faculty and educators describe their social identities as science communicators?

Five common themes appeared during the interviews: continual development, technology, research dissemination, evaluation and motivation, and community relationships. Each of these five themes were discussed in various ways during the interviews. Each participant also had unique associations for the themes, themselves, and how they played into science communication.

Every participant in the interviews discussed the importance of continually growing and adapting for job requirements, to better impact those around them, and for personal growth. Respondents noted that by keeping up-to-date on information, they can portray

themselves as reliable sources. However, knowledge of specific available science communication training was mixed. Most individuals noted that they had received other types of training they had then applied to communicating science to their constituents. Some also noted that they had primarily learned to communicate science through experience. Individuals also discussed the importance of being members of professional organizations and utilizing those opportunities to increase their skills and grow as communicators.

Technology was a major theme discussed by all interview participants. Individuals said that technology acts as a barrier, helps reach new constituents, grants a way of communicating during COVID-19, provides an opportunity for their personal skills and expands extension's reach. Diffusion of innovation theory indicates that communication channels and the social system where it is spread has major influence on how information spreads and is utilized by constituents (Rogers, 2003). Technology was identified as a barrier for rural Idaho where infrastructure and resources are lacking. Technology was also a barrier for older generations of constituents and UI Extension educators and faculty. However, technology has helped UI Extension reach new constituents during COVID-19 and helped communication become more streamlined and efficient. Results from this study demonstrates technology is barrier and an area for opportunity. The results can be paired with the concepts of diffusion of innovation theory to provide an outline on how technology can be utilized based upon individual demographics and access to technology (Rogers, 2003).

A few individuals also discussed how technology has provided a key opportunity to increase extension's impact and reach. They articulated how increasing an office's presence on social media and becoming more efficient at producing high quality, eye catching videos could help increase the reach of UI Extension and transform it into a more commonly utilized

resource. In the past, extension has been able to change and adapt its model to become trustworthy sources of information for agricultural producers (Buys, 2020). Technology provides an opportunity for extension to continue to adapt and grow to be utilized by new audiences. Technology can also assist in the innovation-decision process. Specifically, technology can play a key role in the knowledge stage and assist in bringing new information to constituents (Rogers, 2003). An individual must be exposed to information in the knowledge stage to begin the process. Technology can help to bring interesting and impactful information to constituents and start the innovation-decision process (Rogers, 2003). Those working within extension can act as opinion leaders and break ground to help increase the utilization of technology for information transfer (Rogers, 2003). Individuals who are more open to utilizing and growing their technology usage will be able to reach more individuals and more efficiently disseminate research-based information to constituents and the public.

All participants indicated one of their key responsibilities was to disseminate research-based information to the public. Most individuals said the information they provide to constituents should be research-based and from land-grant universities. Furthermore, if it comes from industry businesses or private research, they noted it is important to support that information with other land-grant university research. This may indicate a lack of understanding on how to deem research reliable that is outside of the land-grant university system. Extension has a reputation as a trustworthy source. For instance, they played a large role in bringing hybrid corn into agricultural productions (Stephenson, 2003). This concept indicates both constituents and extension professionals trust and rely on the research conducted by UI and other land-grant universities, fulfilling the mission of CES (Seevers & Graham, 2012). This also validates the concept that it is the job of the science communicator

and the role of UI Extension educators and faculty to provide research-based and reliable information to their constituents. Previous research has also found the key role of extension is to provide accurate and reliable information (Kurtzo et al., 2019). Extension educators and faculty should continue to uphold that role by relying on accurate and science-based information.

Participants noted a major barrier to research dissemination was when constituents are stuck in their ways and unreceptive to new or different information. Extension educators and faculty have an opportunity to utilize their roles as opinion leaders in their communities and work towards breaking down this barrier to information (Rogers, 2003). Opinion leaders have an important role in introducing information and impact the likelihood of the information being accepted by constituents (Rogers, 2003). Furthermore, those working in extension have proven themselves to be important and influential opinion leaders who introduce early adopters to new findings and research-based information (Stephenson, 2003). Extension professionals can get to know their audiences and frame information specific to their backgrounds and needs to increase the chance of acceptance and utilization (Robinson, 2013). Once they understand their audience and their needs, they can utilize their roles as opinion leaders and introduce information that can be diffused in communities and help to combat misinformation and lack of interest (Rogers, 2003). For example, an extension professional that is an opinion leader within a community have an opportunity to introduce new farming and agricultural practices to constituents that might not have been deemed trustworthy before.

The next common theme appearing during the interviews was evaluation and motivation. Participants indicated the most common way they evaluated the effectiveness of

their communication was through formal evaluations, indicating they value the reliability of data and information to back-up the impact of their programming. They noted the importance of being able to provide concrete evidence to their employer and communities to exhibit the impact of the programming. To ensure the longevity of CES, it is important that communication and programming is utilized by the public (Ray et al., 2015). Evaluations serve as an effective and concrete way to provide evidence of utilization and effectiveness.

Participants also indicated that they are motivated to fulfill their requirements as UI Extension educators and faculty because they are passionate about their jobs. This concept aligns with social identity theory; an individual who sees themselves as being part of a group and having an impact is more likely to continue to act on the group norms than those who do not align with the group (Tajfel, 1974). Participants indicated that being communicators of science-based information was important and had actions that supported their identification with the group.

Community relationships were the next theme emerging during the interviews. In order to have impact as science communicators and as extension educators and faculty, participants said that they needed to build and maintain relationships with those in their communities. They indicated personal relationships often help to increase their sense of reliability; however, playing politics and building mutually beneficial relationships was also necessary on some occasions. Specifically, they conveyed the necessity to be genuine and caring with constituents. Extension needs to remain well-utilized and visible to prove its importance (Ray et al., 2015). Respondents expressed building concrete personal relationships within the community can lead to professional relationships and create more exposure. The innovation-decision process relies on relationships between constituents and

those who introduce them to information (Rogers, 2003). Therefore, building and maintaining trusting relationships within communities and on a personal level can help individuals to disseminate research and transmit information to those around them. Extension educators and faculty can start the innovation-decision process by introducing their constituents to new information (Rogers, 2003). This process also requires the utilization of appropriate communication channels and framing of messages to meet the constituent's needs and interests (Rogers, 2003). Utilizing the concepts of diffusion of innovation theory and innovation-decision process can help to increase dissemination of information. Therefore, it can also then lead to more individuals seeing UI Extension and CES as a whole as an important and reliable source.

The majority of interview participants directly aligned themselves with being science communicators. However, one individual stated they did not identify as a science communicator. Instead, they indicated that they believed their role was to connect their constituents with those who have scientific knowledge of the subject or science-based resources. This individual's outlook on their role and responsibilities aligned with the perceived roles of others who did identify as science communicators. Social identity theory says that those who identify as being part of a group will act on the norms and values of that group (Tajfel, 1974). Further, individuals who align with the role of being science communicators are more likely to act upon the norms of the group (Baram-Tsarbi & Lewenstein, 2017). This includes performing science communication duties and supporting and collaborating with others who also identify as science communicators (Baram-Tsarbi & Lewenstein, 2017).

The individuals who identified themselves as science communicators also noted that it is within their job responsibilities as UI Extension educators and faculty to act as science communicators. These individuals also said they were motivated to be science communicators because of the positive impact it could have on their constituents' lives and agricultural operations. Having a group of UI Extension educators and faculty who identity as science communicators can help increase the exposure and relevance of UI Extension and CES because they are more likely to carry out science communication responsibilities (Tajfel, 1974).

The concepts of framing theory were supported by multiple participants. Information is more likely to be accepted and used if it is framed for a specific audience (Dameen et al., 2001). For example, they noted the importance of understanding the audience's needs, demographics, and access to resources. Once information was understood, they indicated they would prepare their communication and programming for the constituent.

Research Question 3: What is the relationship between social identity as a science communicator and the communication types and channels used by UI Extension faculty and educators?

The communication type most commonly used had an influence on views and identities as science communicators. While a majority of participants noted the importance of being science communicators and aligning with the term, there were notable differences in how they discussed the themes. All participants shared the significance of continual development; however, there was no differentiation between communication type groups.

Technology was utilized differently by each of the communication groups. Within the technology theme, there was not enough data to draw conclusions on the mass

communication group. However, those who used group and individual communication had differences. Those who utilized group communication the most indicated that they encountered many barriers with technology; however, they also noted that there is room for growth and opportunity. This information supports previous research indicating extension must rely on new media channels such as social media platforms and visually appealing videos to continue to disseminate their information (Kurtzo et al., 2019).

Interviewees within group communication indicated they utilized technology in a different way than the individual communication group. Online workshops and programming provide an opportunity for group communication to continue. However, it may have provided opportunities for difficulties and barriers for some of their constituents that had less familiarity with technology or did not have the resources to utilize technology. Continuing to understand audience needs and preferences with technology can provide an opportunity to communicate with constituents more effectively (McDowell & Mizuno, 1987). Those who most commonly utilize individual communication noted how they have an opportunity to increase their technology skills and their impact. Utilizing new concepts and resources can help increase the communication of science-based information. Technology can assist in the innovation-decision process, which can lead to the diffusion of information within communities (Rogers, 2003). Those within the individual communication group wanted to be able to increase their skills in order to reach more people.

Within the research dissemination theme, those who most commonly utilized mass communication conveyed that their role was to connect their constituents to experts. Whereas those who use group communication said their role was to act as a hub to provide their constituents with resources. Those who use individual communication said their role is to

bring UI and other land-grant university publications to their constituents. Those who use mass communication the most tended to streamline the process and once they understand constituents needs; they connected them with the information instead of personally tailoring the information from the experts. This aligns with what would be expected from the communication types. Mass communication is efficient and streamlined, whereas individual communication is personalized and dependent on specific audience needs and demographics. Individuals who used mass communication were interested in making a larger, more widespread impact over a large group of people, compared to a more personal impact for specific people. The role of extension is to act as a channel for research-based information from land-grant universities to constituents (Seevers & Graham, 2012). The participants in this study fulfilled that role. Furthermore, they fulfilled the role in different ways depending on the communication channel they most commonly use and their identities as science communicators.

Individuals in the group communication sector indicated they most commonly relied on data from surveys and evaluations to fully understand their impact. Assessing the impact of communication and adapting based upon the results is important to help increase the impact of extension (Ray et al., 2015). The individuals in the mass communication group seemed to have an appreciation for efficiency in many areas of their communication and research dissemination. This finding aligns with previous research that indicated extension needed to continue to prove itself as effective and well utilized by the public (Kurtzo et al., 2019). Those who most commonly used individual communication noted an importance of observing their constituents picking up on information and asking many follow-up questions to ensure they were grasping the information. This type of interaction aligns with the

communication type because of its personal nature. Individual and personal communication is the traditional communication system that extension was built on (Webster & Ingram, 2007). Those within the individual communication type had an appreciation for personal impact and relationships. Those who most commonly used group communication noted an importance for evaluations as well, but they wanted to see an impact on a community level. These beliefs and actions uphold previous research and publications that emphasized extension leaving a impact to validate its importance (Ray et al., 2015). These individuals discussed the importance of having efficient communication. They also wanted to be able to verify their communities and constituents were positively impacted by information and programming.

There was not enough data available to make associations within the mass communication type and community relationships theme. However, those in the individual communication type group maintained personal connections were important. Further, collaborating with others was a helpful way to disseminate information. Those who most commonly used group communication indicated that developing relationships with their communities could increase their trustworthiness and impact.

There were differences noted in the communication types and views on science communication identity. Those who most commonly used individual communication seemed to be focused on individual impact and relationships with their constituents and those around them. Those in the mass communication group had a preference for efficiency, widespread impact backed up by data and concrete evidence. Those in the group communication realm maintained the importance of community impact, community relationships, and that their role was to disseminate information and keep increasing their skills. The conceptual

framework for this study outlined how identity directly impacts how individuals communicate with their constituents. The findings from this study support and align with the conceptual framework. The conceptual framework and information found in this study can help to understand how to increase effective communication from extension to constituents.

Connections to Longnecker's Integrated Model of Science Communication

Many responses from this study aligned with Longnecker's (2016) integrated model of science communication. Interview participants mentioned the importance of continually growing and adapting to meet job requirements, to benefit their constituents, and for their own personal growth. This information supports the behavior factor within the model (Longnecker, 2016).

One individual explicitly stated they did not align with being a science communicator; the remaining respondents identified as science communicators. Those who identified as science communicators were motivated to communicate science and provide their constituents with science-based information because of the positive impact it could have on lives and operations within their communities. Besides their motivation, each individual had their own specific understanding on what it meant to be a science communicator and uphold that title. Identity is a key aspect of Longnecker's (2016) integrated model of science communication (2016) and directly influences how individuals communicate facts to their constituents.

The motivation to communicate scientific information varied between respondents. Some respondents indicated they were motivated to fulfill their roles as being sources of scientific information. These responses support the affect factor, which represents the individual's motivation to communicate scientific information (Longnecker, 2016). While

specific motivation varied between respondents, their specific motivation to communicate has an influence that leads the individuals to communicate scientific information.

The values factor of the model was identified throughout the interviews as well (Longnecker, 2016). Participants said they tried to maintain specific values when they were communicating science. These values included being honest and fair, and being optimistic were key values they tried to maintain.

Technology emerged as a prominent theme in the qualitative portion of this study. The usage of technology aligns with the skills and behavior factors of Longnecker's (2016) model. New concepts and resources can help to increase the communication of science-based information. Technology can play a key role in science communication and help to disseminate information more efficiently. This concept is supported by the skills factor which describes how an individual is able to communicate more effectively (Longnecker, 2016). Seeking out training to help grow communication abilities is upheld by the behavior factor (Longnecker, 2016).

Conclusions

Throughout the interviews, participants indicated the importance of disseminating information and preparing information for specific audiences. They noted information must be easily understood, usable, and prepared for specific audiences. While this concept was widely discussed, communication gaps between extension professionals and their constituents may exist. Communication gaps pose an eminent problem for extension. Extension needs to understand effective communication strategies and use them strategically to fulfill the need of their audiences and reach new constituents.

COVID-19 and the subsequent regulations have provided and opportunity for UI Extension to expand their technology usage. This has led to opportunities to reach new individuals. However, technology also acts as a key barrier with the prospect of leaving out older and more rural populations due to access. Increasing the reach of extension is vital for its growth and usage (Ray et al., 2015). However, it is important to still tailor communication to rural and older generations who utilize technology less or do not have access to technology infrastructure. Extension educators and faculty should implement audience segmentation and the concepts of framing theory to better serve their constituents (Agunda, 1998). For example, in areas where technology infrastructure is present and constituents actively use technology, extension professionals could implement information dissemination opportunities through social media.

The common themes identified during the interviews indicate UI Extension faculty and educators are motivated to fulfill the roles of science communicators. They have individual actions and motivations, but identify with the importance of providing their constituents with research-based information. The science communication identity of UI Extension faculty and educators is different for each person. However, they all align with and maintain the importance of positively impacting their constituents and communities through reliable and trustworthy science-based information.

There were notable differences between communication types and common themes found in interviews. Those who used individual communication the most seemed to value personal connections and impact. Those within group communication found community impact and relationships to be important, but also found that technology could help them increase that impact. Lastly, the mass communication group relied on data and efficiency to

impact their constituents and disseminate information. There were distinct relationships found between science communicator identity and communication channel type.

Recommendations for Practice

Throughout the interviews, participants indicated technology is an area with major potential for growth. Furthermore, it also has the potential to assist in reaching new audiences and increasing reach and visibility. New media channels provide an opportunity for extension to fulfill its mission of providing research-based information to the public (Kurtzo et al., 2019). Many individuals noted that they were interested in increasing their technology and social media skills. They also noted many of their skill building opportunities are through professional development. Therefore, providing more opportunities for extension professionals to expand their technology and social media skills could be beneficial for the individuals and extension as a whole. Workshops, guest speakers, and online tutorials and videos would be beneficial resources for extension professionals. Therefore, it is recommended that UI Extension provide opportunities and resources for its employees to increase their technology knowledge and skills.

Technology has become heavily relied upon during the COVID-19 pandemic and its subsequent restrictions. However, not all of Idaho has access to the infrastructure and resources required for reliable internet connection allowing constituents to access social media and other technology-based information. Audience needs, resources, and demographics play a key role into how constituents should be communicated with (McDowell & Mizuno, 1987). It is recommended that audience segmentation and framing is utilized, to prevent constituents from becoming disconnected from extension. Understanding what resources constituents have available and how they prefer to receive their information

can help to maintain the connection to traditional, older, and rural audiences. UI Extension faculty and educators face a unique challenge in meeting demographic needs due to Idaho's growing and urbanizing population. Understanding audience's demographics can help to better tailor programming and communication materials (Curtis et al., 2012). While social media and technology-based communication is the most easily utilized, leaning on technology to disseminate information can lead to large portions of Idaho's population to be left behind. Framing theory should be utilized to understand audiences and prepare information for constituents (Dameen et al., 2001).

Accessing resources and information overload were discussed as barriers to information retrieval. One individual noted increasing communication and teamwork throughout the state might lessen this barrier to UI Extension educators and faculty. Individuals emphasized the importance of providing fact-based information and admitting when they did not know the answer to the constituent's questions. Maintaining the sanctity of the trust their constituents have in them and their information lies in remaining truthful and providing only factual, research-based information. It is recommended that information becomes more readily available and accessible, to make disseminating that information to constituents more efficient. This could help to increase the impact of UI Extension. Statewide collaboration and ease of accessing new research can help make communication more efficient.

Many individuals could not identify specific science communication training they wished to pursue but noted they would be interested in it. Making specific science communication training available to UI Extension educators and faculty through professional development opportunities would help increase their knowledge and skills. Furthermore, it

could also help to make science communication a more valued and sought after area of training for other professions and universities. It is recommended to make science communication training available within UI Extension and CES. This training could increase knowledge and skills and have long-term impacts of dissemination of information.

Most of the participants in the interviews explicitly described themselves as science communicators; only one individual said they did not identify as a science communicator. However, everyone had their own interpretation of what they thought it meant to be a science communicator including where they got their information. Training should be developed and implemented that works explicitly towards streamlining the science communication field and UI Extension's role in the field. This would provide synonymous meanings and goals to make science communication an easier area to understand and work towards. Making the norms and expectations of being a science communicator more readily available could lead to more individuals identifying with the group. Therefore, making that information more readily available could help individuals to align and act upon the norms and increase the prominence of the science communication field.

Participants in the study indicated evaluations were the primary way they were able to provide feedback on their programs. It is recommended that collaborative groups and boards be founded. Investing in these organizations throughout the state could lead to more opportunities for UI Extension educators and faculty to specifically tailor their information. Examining UI Extension's statewide communication presence could help to identify opportunities to advance collaboration statewide. Furthermore, providing an opportunity to advance relationships to make communication between programs more efficient could have a beneficial impact on the dissemination of information.

Recommendations for Research

It is recommended this research be adapted and replicated to understand the constituent's perspective, which is missing from this study. Participants were directed to rank their constituent's more preferred communication channels as well as their own. There is no indication that the information provided directly aligns with constituent's actual communication channel preference. Respondents also ranked communication channel preferences for their audience. Responses might have differed if respondents were asked to segment their audiences before responding or were asked about specific demographic groups. Specific audience groups have different preferences for communication based upon demographics, culture and values impact individual's preference for information (Li & Su, 2018). For example, further research about how constituents prefer to communicate with extension professionals would help to uncover this phenomenon. Furthermore, because this research focuses on the extension professional's point of view, including constituents could provide further insight into barriers they might have when accessing extension information, and what barriers they have faced that prevent them from utilizing extension. Further research could be conducted to examine the demographics and values within Idaho impacting the utilization of UI Extension programming, information, and resources. Understanding the population currently utilizing these resources and who is being missed can provide an opportunity to specifically frame information. Tailoring specifically to missing audiences will increase the likelihood they will become interested and utilize information (Robinson, 2013).

Many individuals noted they commonly rely on formal evaluations to indicate the effectiveness of their programming and communication materials. While this type of

evaluation does provide data and digestible information describing the communications, it often lacks respondents and leaves out constituents. Individuals have to opt-in to taking part in surveys or evaluations or attend programming. Further research is recommended to investigate why some individuals choose not to attend or partake in programming. This information could lead to understanding what audience is currently being missed or not buying into extension programming.

There were limited respondents who indicated they used mass communication the most often. Extension educators and faculty need to provide information to the public that is well utilized (Ray et al., 2015). Mass communication can serve as a fast and efficient way to communicate with many constituents at once. Further research could be done to investigate why more Extension educators and faculty do not use mass communication more often.

This research targeted all UI Extension educators and faculty. Further research could be conducted to examine if results differed based upon program areas; specifically, if individuals working in different program areas had differing views on themselves as science communicators. The differences in their preferred communication types and channels could also be researched to understand what impact program area has on communication. Previous research has found that demographics, values, and background experiences impact preferred communication (Lamm et al., 2019). Individuals from different research areas might have differing science communication identities because their values, motivations, and perceived importance of communication may vary based upon demographics, culture, and other background information. Extension professionals within horticulture and community development might see their role in science communication differently based upon values, experiences, and other background information.

This study could be replicated or adapted to examine how those working in extension in other states view themselves as science communicators. Other states could have differing results due to many influential components. According to Longnecker's (2016) integrated model of science communication culture, values, and engagement can all impact individuals' views and experiences with science communication. Those components could differ in other state locations.

COVID-19 and its subsequent restrictions has caused extension to make many adaptions and changes to their programs and communication. Many participants said they believe the adaptations and changes they have had to make will stay around long-term. A longitudinal research study could be conducted evaluating the impact COVID has into the future on the way those within extension communicate with their constituents.

Limitations of the Study

This study only included the perspective of UI Extension educators and faculty who responded to the initial survey. Assumptions were made that constituents agree with the rankings that were provided by respondents. These rankings might differ from how their constituents truly prefer to communicate.

Only 12 UI Extension educators and faculty were interviewed during the qualitative portion of this study. Attempts were made to interview an additional four individuals. However, due to time and COVID-19 restrictions, those interviews were not able to happen. While it is believed that the information that was gathered is reliable, the limited number of participants should be considered before broadcasting the information found onto larger populations.

Only two individuals whose primary communication type was mass communication were included in this study. In the quantitative portion of the study, mass communication was utilized the least. The information provided by those in the mass communication group might not be representative of others throughout the state that fall in the group due to the low number of participants.

Summary

Science communication identity and communication types were found to have distinct relationships. Participants in the study had diverse motivations for communicating science. However, they all emphasized their roles as spreading reliable, research-based information to constituents. Science communication identity was found to be an adaptable and flexible title. The findings of this study can help UI Extension and CES to more effectively communicate with their current constituents and target new audiences. By doing this, extension will be able to fulfill its mission and prove itself as being an important and reliable source.

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Appendix A - Survey

		Source
Pre-COVID/Normal Year		
How often have you utilized the following communication channels?	Select: Never, monthly, biweekly, weekly, daily, or more than daily	Kurtzo, et al., 2019
	Facebook	
	Instagram	
	Twitter	
	YouTube	
	Other Social Media	
	Walk-in/In Person	
	Text	
	Phone Call	
	Email	
	Mailed Newsletter	
	Emailed/Online Newsletter	
	Website	
	Magazine	
	Radio	
	Television	
	Other:	
What percent of your time is spent communicating in each of the communication types?	% of time spent	Seevers & Graham, 2012
	Individual (eg. communication between two people)	
	Group (eg. communication between a work group, audienc, organization)	
	Mass Communication (eg. communication through a media channel to reach a large number of people at the same time)	
Current Outgoing Channels/During COVID-19 Pandemic		
How often have you utilized the following communication channels?	Select: Never, monthly, biweekly, weekly, daily, or more than daily	Kurtzo et., 2019

	Facebook	
	Instagram	
	Twitter	
	YouTube	
	Other Social Media	
	Walk in/In Person	
	Text	
	Phone Call	
	Email	
	Mailed Newsletter	
	Emailed/Online Newsletter	
	Website	
	Magazine	
	Radio	
	Television	
	Other:	
What percent of your time is spent communicating in each of the communication types?	% of time spent	Seevers & Graham, 2012
	Individual (eg. communication between two people)	
	Group (eg. communication between a work group, audience, organization)	
	Mass Communication (eg. communication through a media channel to reach a large number of people at the same time)	
Time Spent Communicating	% of time	
During a typical work week, what percentage of your time do you spend communicating with constituents?		Seevers & Graham, 2012
During a typical work week, what percentage of your time do you spend preparing communication materials?		Seevers & Graham, 2012

Preferred Communication Channels		
Rank the following communication channels from your most preferred to your least preferred?	Ranking	Kurtzo et al., 2019
	Social Media	
	Walk-in/In Person	
	Text	
	Phone Call	
	Email	
	Phone Call	
	Mailed Newsletter	
	Emailed/Online Newsletter	
	Website	
	Magazine	
	Radio	
	Television	
	Other:	
Rank the following communication channels from your constituents most preferred to their least preferred:		
	Social Media	
	Walk-in/In Person	
	Text	
	Phone Call	
	Email	
	Mailed Newsletter	
	Emailed/Online Newsletter	
	Website	
	Magazine	
	Radio	
	Television	
	Other:	
COVID-19 Impact	Open ended question	
How has the COVID-19 Pandemic impacted your outreach actions?		Narine & Meier, 2020
How do you predict COVID-19 Pandemic will		Narine & Meier, 2020

impact Extension and your work long term?		
Demographics		
Age		
Gender		
Race		
County:		
Tenure Track:		
Rank:		
Program Area:		
Position Title:		
District/Location:		
How long have you working within Extension?		
How long have you worked within UI Extension?		

Appendix B: Interview Protocol

Understanding

1. What do you think it means for someone to identify as a science communicator?
2. Define communication as it relates to you and your position and program area?
3. Do you identify as a science communicator?
    a. If Yes, explain why
    b. If No, explain why not?

Affect

4. What motivates you to communicate with the public?

Values

5. In your job position, what are your responsibilities when communicating with the public?
6. What principles (e.g., attitudes, opinions, values) do you maintain as you interact with the public?

Awareness

7. What resources do you use most often when communicating with others about your program area or research?
    a. If None, What are the barriers to you not using science communication resources?
    b. If Resources Are Listed, How do you use these science communication resources to help you better communicate science?

Skills

8. What methods do you use most often when you communicate with your constituents?
9. How does your audience impact your types, and mediums of your communication?
10. How do you evaluate the effectiveness of your communication?

Behavior

11. If any, what are the types of formal science communication training you have pursued?
12. If any, what are the additional types of science communication training you would be interested in receiving?

Attitudes

13. What impact can you make as a communicator within your program and research area?
14. How do you convey yourself as a reliable and trustworthy source of scientific information?

Beliefs

15. Is communicating research and information about your program area a valued part of your position?
16. What role should a scientist play in discussing scientific issues with the public?

Appendix C: Informed Consent

Investigators: Klae O'Brien, Sarah Bush, & Kattlyn Wolf

Purpose of this Research

The purpose of this study is to examine what impacts a University of Idaho Extension Professional's social identity as a science communicator has on the communication channels and types they utilize to communicate with constituents.

Procedures

If you consent to the conditions and agree to participate, you will be asked to complete the following survey and demographic questions. Participation in this survey will take approximately 5-10 minutes. Following the completion of the survey, you will be given the opportunity to enter your contact information if you are willing to participate in a follow-up interview.

Risks

Anticipated risk is minimal.

Benefits

No promise or guarantee of benefits have been made to encourage you to participate. The results of the study will provide insight on science communication identity and communication channels and types utilized by UI Extension Educators and Faculty.

Extent of Anonymity and Confidentiality

Information gathered will be kept confidential. All information will be stored on password protected devices by Sarah Bush. All identifiable information will be removed from the data and replaced by pseudonyms. The data will be kept confidential to the extent allowed by

federal and state law. Under certain circumstances, information that identifies you may be released for internal and external reviews of this project.

Freedom to Withdraw

You are free to withdraw from this study at any time without penalty. You are free to not answer any question that you choose without any penalty.

There may be circumstances under which the investigator may determine that a participant should not continue as a participant.

Participant Responsibilities

I voluntarily agree to participate in this study. I have the following responsibilities: to complete the following survey and demographic questions.

Questions or Concerns

If you have any questions or concerns about this research study, please feel free to contact Sarah Bush at 208-885-6362 or sabush@uidaho.edu. If you would like to report a complaint about this study, you may call the Office of Research Assurances at 208-885-6340, or email irb@uidaho.edu.

Participant's Permission

I have read the Consent Form and conditions of the study. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent. Submission of this survey implies my consent to participate in this research study.

Appendix D: Verbal Consent for Interviews

This interview will be recorded. Is it okay that I start recording?

Klae O'Brien, Sarah Bush, and Kattlyn Wolf from the Department of Agricultural and Extension Education are conducting a research study. The purpose of the research is to understand how a UI Extension Professional's social identity as a science communicator impacts how they communicate with their constituents. You are being asked to participate in this study because you fulfill the qualifications of being an Extension Educator or Faculty and have received at least a master's degree or PhD.

Your participation will include a recorded Zoom interview that will take approximately 30 minutes to complete. Zoom Privacy Policy and Terms of Use are available below. The interview includes questions pertaining to your social identity as a communicator. Your involvement in this study and the interview is voluntary, and you can choose not to participate. You can choose to end the interview at any time or not answer any question without penalty. The information you provide will be kept confidential. Interviews will be transcribed verbatim via Dragon Diction Software, and all identifiable information will be removed and replaced with pseudonyms. Dragon Diction Software Privacy Policy and Terms of Service are available below. There are no known risks in this study. Individuals will have the opportunity to approve any direct quotes, and personal information will not be distributed or used for future research. Data will be kept and maintained by Sarah Bush on password protected devices.

If you have any questions about this research project, please contact Sarah Bush at 208-885-6362 or sabush@uidaho.edu. If you would like to report a complaint about this study, you may call the Office of Research Assurances at 208-885-6340, or email irb@uidaho.edu.

By verbally consenting to this you certify that you agree to participate in the previously described research study. Do you consent (yes or no)?

Privacy Policy and Terms of Service for Dragon Diction Software:

https://www.dragondictationsoftware.com/privacy-policy/

Zoom Terms of Service:

https://zoom.us/terms/#:~:text=%20ZOOM%20TERMS%20OF%20SERVICE%20%201%20DEFINITIONS.,as%20Beta%20version.%20Access...%204%20MISCELLANEOUS%20More%20

Zoom Privacy Policy:

https://zoom.us/privacy/

Appendix E: Interview Recruitment

Interview Email Recruitment

Hello,

Thank you for your participation in my survey regarding how UI Extension Educators and Faculty communicate with their constituents. I would love an opportunity to connect with you to schedule a follow-up interview.

The follow-up interview will be via Zoom and approximately 20 minutes long and inquire about your identity as a science communicator. Your responses will be confidential. Identifiable information will be removed and replaced with pseudonyms.

Please let myself (obri5038@vandals.uidaho.edu) or Sarah Bush (sabush@uidaho.edu) know if you have any questions or concerns.

I look forward to hearing back from you,

Klae O'Brien

Interview – Phone Call Recruitment

Hello,

Thank you for your participation in my survey regarding how UI Extension Educators and Faculty communicate with their constituents. I am reaching out to schedule a follow-up interview.

The follow up interview will be via Zoom and take approximately 20 minutes and inquire about your identity as a science communicator. Your responses will be confidential. Identifiable information will be removed and replaced with pseudonyms.

Do you have any questions, or would you like to continue with scheduling a time for an interview?

Appendix F: Survey Recruitment

Recruitment Email

SUBJECT LINE: UI Extension Science Communication Identity Study: Participation Request

Hello,

I am a master's student at the University of Idaho in the Agricultural Extension and Education Department and conducting my thesis research. The purpose of this research is to investigate how UI Extension Educator and Faculty's identity as a science communicator impacts how they communicate with their constituents. You are being asked to participate in this research study because of your position within UI Extension.

The survey linked below is confidential and will take approximately 5-10 minutes to complete. The survey includes questions regarding preferred communication channels and types and demographic questions. Upon completion, you will be given the opportunity to provide your contact information to be invited to participate in a follow-up interview.

The survey should be completed by March 16.

If you have any questions or concerns, please feel free to reach out to myself obri5038@vandals.uidaho.edu or Sarah Bush sabush@uidaho.edu.

Thank you for your time and willingness to participate,

Klae O'Brien

First Reminder

SUBJECT LINE: Your participation in the UI Extension Science Communication Identity Study is important

Hello,

Last week you were sent an email inviting you to participate in a survey regarding how UI Extension Educators and Faculty communicate with their constituents. If you have already submitted the survey, thank you for that valuable information. If not, I am inviting you to complete the survey linked below by March 16.

If you have any questions or concerns, please feel free to reach out to myself obri5038@vandals.uidaho.edu or Sarah Bush sabush@uidaho.edu.

Thank you for your time and willingness to participate,

Klae O'Brien

https://uidaho.co1.qualtrics.com/jfe/form/SV_6MwaMyMOgO5fTLM

Second Reminder

SUBJECT LINE: Your participation is vital to UI Extension Science Communication Identity Study

Hello,

Two weeks ago, you were sent an email inviting you to participate in a study regarding how UI Extension Educators and Faculty communicate with their constituents. If you have already completed and submitted the survey, thank you for that valuable information. If not, I am inviting you to complete the survey linked below by March 16.

If you have any questions or concerns, please feel free to reach out to myself obri5038@vandals.uidaho.edu or Sarah Bush sabush@uidaho.edu.

Thank you for your time and willingness to participate,

Klae O’Brien

https://uidaho.co1.qualtrics.com/jfe/form/SV_6MwaMyMOgO5fTLM