Science Communication and Ethics—The application of Kohlberg's moral reasoning to science communicators in Canada

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A thesis submitted in partial fulfillment of the requirements for the degree of Masters of Arts in Communication

January 2018

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Acknowledgements

I would like to first and foremost thank my supervisor, Dr. Anthony Yue, for all of his mentorship and support throughout my degree and thesis process. The guidance you have given me over the years is truly immeasurable and I sincerely appreciate it.

To my thesis committee, Dr. Scott MacMillan, and Dr. Alla Kushniryk, thank you for your expertise and advice. I appreciate all of your time and effort.

To the Social Sciences and Humanities Research Council of Canada (SSHRC), thank you for funding my thesis project.

Finally, last but not least, thank you to my parents, as well as my husband, Matty, for your unwavering support and encouragement.

Abstract

The field of science communication is unique. Essentially, it is a blend of the world of science and the world of communication. Science communication is not a new concept, but surprisingly, as an emerging field, not much of it has been studied in depth.

According to a 2011 call for papers, the intersection of science communication and ethics is an area of research that scholars want to see expanded, because the current information is limited. Using a lens of ethical reasoning, the following study looks at science communicators and their approach to solving these ethical situations. This study looks at ethical decision-making and the application of the moral philosophy of Lawrence Kohlberg to science communicators today, as well as uses the work of Kohlberg as a philosophical underpinning.

Kohlberg is famous for his work in psychology, measuring the moral reasoning of individuals, from children to adults (Kohlberg, 1981). His six-stage philosophy of moral reasoning ranges from the basic moral reasoning of an individual aged three to four, to a final stage of complete morality at adulthood.

To measure the moral reasoning of science communicators, a sample of science communicators were administered the Defining Issues Test (DIT). This measure is based in Kohlbergian moral reasoning, but adaptable for multiple-choice formats. The DIT has a series of vignettes that the participant reads and then chooses the most important factors from each vignette. The score is then tabulated and given a P value which correlates to its own level of moral reasoning (Rest, 1986).

Additionally, the Unified Theory of Acceptance and Use of Technology (UTAUT) measure was added to look at the current landscape of science communication and technology. After a preliminary exploratory study in 2014, it was indicated that science communicators might feel

anxiety when using social media (as it is commonly associated with communication jobs). Since social media is so prevalent in today's culture, it was decided to explore this point further using the UTAUT to measure the acceptance of a technology, in this instance, social media (Venkatesh, 2003).

In composition, the study utilized an online questionnaire format, via the online question platform, Qualtrics, and science communicators were recruited via email invitation. The questionnaire included an informed consent, brief demographic questions, the DIT and the UTAUT measures. The questionnaire was live for five months, and had a sample response rate of 37. Out of this sample, 17 of the 37 responses were viable.

When the results were tabulated, no significance was found between gender and social media anxiety, or level of moral reasoning and work experience, and age, but significance was found after tabulating the morality scores of science communicators versus the mean scores assumed for DIT, and Kohlbergian ethics. This resulted in the study finding that the sample of science communicators had a higher level of moral reasoning than the average population.

Although the sample size was statistically insignificant, the study showed that science communicators can be measured for moral reasoning and gives insight into the basis behind their decisions. Moving forward this study has potential to be expanded to a larger sample group, to see if the results still show significance on a larger scale as well as sets a basis for more exploration in the field of science communication and ethics.

This study was funded by the Social Sciences and Humanities Research Council of Canada

Key words: science communication; ethics; Kohlberg; Defining Issues Test, moral reasoning

Introduction

Science communication is a diverse area of study and practice. In fact, the field is so broad that it is just as hard to define as it is hard to describe. Overall, it appears that the nature of the field leaves many confused as to what exactly science communication entails, in general, and as a whole. For instance, some may believe the science communication is strictly public relations or communication studies, scientists presenting their research, or the science of communicating. In all actuality, it can be all of the above. This general shortage of definition hints at the depth of science communication, and the various facets it can take, making it hard to clearly define as science communication involves many career paths. This study examines the basic perception of science communicators when faced with challenging, morally taxing, situations as exemplified in vignette-style scenarios aimed to gauge moral reasoning. These vignettes ask a series of questions regarding the participant's ideas of moral correctness. Additionally, participants were also asked about their perception of the technological tools that often accompany the occupation, while exploring this distinct field more in depth, such as the usefulness and their apprehension for social media sites.

Science Communication Defined

The realm of science communication is extremely diverse and cannot be boxed into a small definition in a textbook, or even a chapter in a book, because it is much more than that, and therefore makes it complicated to explain and even more complicated to completely understand, or in turn, study. However, it is safe to say that science communication involves the communication of scientific matter, details, and discoveries.

To begin, a static, all encompassing, definition of science communication is not easy to find and to each science communicator the definition is probably different. In scholarly works, a few academics have attempted to describe science communication in a general manner for simplicity sake.

Burns, O'Connor, and Stocklmayer (2003), refer to science communication as being a continual process, compared to a linear, systematic, way of communicating important information. Meaning that the definition of science communication is evolving with science communication itself and it is not a neat and easy definition. This makes sense as science is also constantly evolving. In fact, while Burns and colleagues (2003) were researching, they discovered surveys that show results that scientists are not well informed on the public (from a communication standpoint) and vice versa. The struggle of explaining complicated scientific information to the public and not losing the meaning is difficult. Keohane, Lane, and Oppenheimer (2014), suggest that scientists are constantly under the influence of uncertainty and therefore should understand the basic principles of science communication to ensure that the understanding of the public becomes a higher priority for the scientists and that the public understands what is being told to them. The five principles of scientific communication, under the conditions of explaining uncertain scientific data are: audience relevance, process transparency, honesty, precision, and finally, being specific about any known uncertainties in the research (Keohane et al, 2014). The interest in science, and scientific discoveries, is not lost on the general public, but the overall understanding of science remains a hardship (Burns et al., 2003). This is the gap in which science communication thrives, and has increasingly become more important for both realms of science, and communication, as a whole. Science communication needs to be achieved in a manner that allows the information provided to be explained with ease and simplicity, but not lose the important scientific information.

Communicating science is more than repeating the methodology of the latest scientific discovery. Science communication is also an understanding, appreciation, and the use of an appropriate communication technique for relaying the information. In many cases, this could vary per issue being discussed. To roughly put together a definition of science communication may not do the

discipline justice, and simply put, a standard definition is extremely rare to come across (Burns et al., 2003). However, Burns and colleagues (2003) decided to define science communication using various communication-related terms, and surveying the field to create a definition that suits all areas of science communication. The over encompassing definition that they have established is as follows:

> *"Science communication (SciCom) is defined as the use of appropriate skills, media, activities, and dialogue to produce one or more of the following personal responses to science (the AEIOU vowel analogy):*
>
> - *Awareness, including familiarity with new aspects of science.*
> - *Enjoyment or other affective responses, e.g. appreciating science as entertainment or art.*
> - *Interest, as evidenced by voluntary involvement with science or its communication.*
> - *Opinion, the forming, reforming, or confirming of science-related attitudes, and*
> - *Understanding of science, its content, processes, and social factors*
>
> *Science communication may involve science practitioners, mediators, and other members of the general public, either peer-to-peer or between groups"* (Burns et al., 2003).

This definition incorporates science communication as a whole—from the basics of what it includes to whom in involves and it exemplifies the issue surrounding defining the discipline and exactly how hard it is to contain it within a few words. In consideration to this discipline and the wide range of study and research, the career opportunities for professional science communicators are just as diverse. For instance, a professional science communicator may be a university professor or a public relations specialist. Thus, the career path of the science communicator is expansive and there are probably many science communicators currently practicing in the discipline that do not consider

themselves as such. The issue that many science communicators do not identify as being a science communicator creates an even bigger population currently practicing in reality.

According to Burns and colleagues (2003), over the past two decades the number of professionally practicing science communicators has steadily increased. There are many factors that could attribute to this outcome including an increase in scientific discoveries, the public's increased interest in science, or the fact that science communication has come to terms of being a discipline of its own. However, when considering the historical cases of discussing science, the idea of science communication has been around for a very long time whether it has been considered as a professional entity or not (Brake & Weitkamp, 2010).

The unique career paths that a science communicator can take, as mentioned, varies in range and includes, but is not limited to, public relations/communication roles, working in media (newspapers, television, radio, the internet), working in education and academia, and working in science-related roles and careers. These careers all take place while incorporating the proper presentation of science (Brake & Weitkamp, 2010). In some of these careers, roles can also often overlap. It is common that the person communicating science for the scientists, or scientific organization, taking the role of science communicator. The science communicator becomes split between the two disciplines of science and communication and must make decisions on behalf of communications, science, audience, and their respective workplace. When looking at the field professionally, each day can be different, each job can be different, and each science communicator develops and must solve, different dilemmas. It is important to note that with an increase in occupations, and attention to science communication, the individuals in science communication positions becomes more prevalent to research as a group themselves. Science communicators are a multi-faceted group of individuals dealing with research on a daily basis. The research available on

science communicators, as a group, is limited. The current research available is less broad in nature and more specific, making it hard to distinguish a general consensus on particular areas of interest. When completing an overall search for science communication research, the results show that science communication research is seemingly either extremely specific to a small group (based in a research study) or broad in information, such as text explaining how to communicate science. For example, research studies of a small nature examining the roles of science communication in the news, or a complete volume explaining the nature of science communication.

From a macro level, the occupations of science communicators are as broad as the subjects they communicate, but there is a commonality- the nature of their communications. The science being communicating can be at the cusp of new discoveries, be important health-related information, or be public service announcements, to name a few. However, like with any communication, this can lead to situations of an ethical nature when individuals are expected to choose their own verbiage to explain complicated scenarios. Can word choice and presumptive behaviours lead to decisions of an ethical nature, or can the underpinnings of a company play a role in how the information is communicated on a particular object or event? These were factors contemplated when creating this study.

According to Theise and Weigold (2002), science communication can provide the essential information needed to mold the public's opinion on science. This seems positive when relaying messages about the newest discoveries, or breakthroughs, but it does have its own set of dangerous implications. For instance, the metaphorical waters become muddied when science is not viewed as being "newsworthy enough" by a news editor and is cut from the evening news, or when science is communicated for the purpose of obtaining the publics approval to gain scientific funding and

therefore depicting the science through a particular lens (Theise and Weigold, 2002). Out of nowhere, the science communicator becomes an ethical pawn depending on what they communicate and why.

Science Communication and Ethics

The need for science communication is increasing globally, and the importance of appropriate, truthful, and proper communication is necessary (Burns et al., 2003). Scientists are constantly working with uncertainty surrounding their research and the nature of the practice of science in general. Science communicators have the task of communicating uncertainty effectively and so that non-scientist individuals understand the importance of what is being communicated (Keohane et al, 2014). With each new scientific discovery, achievement, problem, or crisis, the information is communicated in some way. Therefore, when this information is being transferred, it is important that the science communicators convey the proper information, in the appropriate manner. As stated previously, the daily occupational duties of a science communicator differ significantly depending on career, and in turn, the dilemmas that arise are also different. When an occupation contends with scientific information, professionals in that field are expected to handle the information to be communicated with a sensitive and ethical nature.

Scientific information that is communicated can sometimes be quite sensitive. For instance, consider the ethical implications that surround topics such as assisted suicide. In the instance of science communication, someone will be responsible for explaining the scientific background to the process. Clearly, this issue is a hot topic involving ethics, but it also encompasses science communication as well. When communicating science there is an added pressure to not only properly represent the science, but also make the information easy to understand for all publics.

According to Trevino (1986), issues of an ethical nature are always present in uncertain conditions when various stakeholders are involved, values and interests are either in conflict, or the

laws are not clear. This makes situations in which science communicators are involved necessarily subject to criticism by various publics. When an ethical dilemma arises in the workplace, or involves the communication of science, how does a science communicator go about solving their problem and acting as ethically as possible? Or in some instances, as in the example of the news editor cutting a science story because it is not exciting enough, the ethical boundaries of a science communicator are questioned (Treise and Weigold, 2002).

This question itself has led to a series of inquires and the basis to this research study. Unlike the discipline of public relations and communication studies, there are no set ethical guidelines for the science communicator in place by an overriding society for professional development (for example, the Canadian Public Relations Society (CPRS)). Although these guidelines are not strictly enforced in public relations/communications, they remain as a guidance tool for the professionals in the field to follow or call upon in uncertain situations. Science communication is distinct from the field of communication, and does not fall entirely under the realm of the CPRS or any other governing communication body; thus, such professional codes of conduct are not available for consultation and guidance.

Moreover, the ethics of science are constantly changing and consequently the nature of ethics in the discipline of science communication is also evolving with the field. Essentially, each new discovery or scientific endeavor brings its own set of ethical guidelines and boundaries. Such fluidity seems contrary to the more static communication ethics, but the discipline of science communication is a hybrid of both. Many professions have an ethical standard by which people are expected to abide (for example ethical code of conducts for professionals, such as doctors). This further indicates that the ethics of any discipline are important factors in the moral decisions that are made surrounding the people, the places, and the things they impact. These decisions not only determine specific outcomes,

but are also similar to a code of conduct regarding how professionals in their respective field act and make ethical choices for not only themselves, but their organization as well. The absence of articulated ethical guidelines means that each instance of ethical uncertainty is met with a personal decision. The moral compass of a science communicator also has to serve as their ethical guideline when communicating in a field without an overarching ethical boundary, or for simplicity sake, an overriding "code" determining how to make ethical decisions.

Personal Relevance

Academically, and professionally, I am a science communicator. Working in a diverse field in terms of career context, I often meet many fellow science communicators working in various areas and communicating vast arrays of information. In my day-to-day professional career, I have to make choices regarding what science I communicate and what methodology to use to do so. Many times what I say has to be presented in such a way that it remains neutral and does not reflect the views of different people, countries, groups, or myself. This takes ethical balance to ensure that everything is reported neutrally. In my career, I also have to be careful not to communicate confidential information or information that could lead to ethical issues. During these times, my personal moral and ethical reasoning is put to the test to do my job, and to ensure that I am meeting the expected professional and ethical standards of my organization.

Academically, I have learned the importance of communicating truth, accuracy, and audience engagement while using the most effective communication tools to reach my audience. I've learned how to handle particularly difficult situations, speak to large groups comfortably, and recognize science communication at a local and broader context. This also includes the ability to acknowledge ethically sensitive situations as well as situations where ethical problems may arise within particular subject fields.

Overall, I am familiar with science communication for someone early in their career stages, however that being said, when I have to make a complicated or difficult decision with ethical implications, I have to depend on myself and my moral reasoning to do so. In some instances, I can ask for assistance from colleagues, but I cannot base my career decisions around ethical standards for science communication, because these guidelines do not exist. The ethical and moral decisions made are based on the ethics and morals of science communicators themselves. This is why this research study is particularly important to me, and my field, because it is based around the idea that if science communicators are not using an ethical guideline in which their decisions are based, they have to use their intrinsic knowledge. This is important in a growing field, with a lack of ethical guidance and information. Personally, as a science communicator, increased information on the field not only helps create a better understanding of science communication, but also furthers the legitimacy of a growing field.

The following chapter will go into detail about the literature review, and philosophical underpinnings of the study, looking at the levels of moral reasoning for science communicators currently working in the field. The study utilizes moral reasoning as a basis seeing as how science communicators, such as myself, are currently using their own morals and personal ethics to make important decisions within their careers and on behalf of their organization.

Chapter 2- Literature Review & Philosophy

After reviewing the literature surrounding ethics, science communication, and the ethics of science communicators themselves, the results were generally lacking. Although science communication research has increased in the past few years, the particular area of science communication and ethics is wanting. I had little literature to draw upon.

Nevertheless, although finding scholarly literature that fully explored science communication ethics and the ethics of science communicators was extremely difficult, there were instances in which scholars have suggested that the area of science communication and ethics ought to be explored in depth. This is important, because although there is lack of research, it is not because of lack of interest in the area. For instance, a research study conducted by Treise and Weigold (2002) surveyed over 800 science writers, and those they had classified as science communicators, and asked them, in an open-ended survey, what they thought were the most important questions, opportunities, and/or unresolved issues within the field of science communication. Out of the 800 surveys sent, 497 science communicators replied. The issues coded were placed into five different categories, one of which was ethics. Out of all of the respondents, 261 science communicators flagged the topic of ethics as important. This is meaningful, because it points to the fact that science communicators themselves see ethics as an issue in the workplace, and for the field as a whole, and that should be explored further. In fact, the participants noted that when communicating science, the hype and the publicity used to promote what is being communicated also comes with ethical implications. For example, if a science communicator is communicating a scientific discovery that needs research funding, it raises the question as to if they are communicating ethically or swaying their communication for the purpose of securing funds. This causes an ethical dilemma, and forces the science communicator to make an ethical decision based on the best way forward to deal with the communication topic at

hand. In these types of situations, it would be beneficial to have a guideline in terms of how to undertake ethical science communication or to have ethical standards in which science communicators have to abide.

Additionally, Keohane, Lane, and Oppenheimer (2014) noted that it is particularly important that scientists understand the ethics behind the information they are communicating, and also that ethicists and policy makers should work together. In fact, Keohane and colleagues suggested,

"The intuitions of practicing scientists about what words mean to others may not be reliable guides to communication; and the intuitions of different sets of scientists could be quite different, leading to inconsistency. It is therefore important for students of ethics, and of politics, to collaborate with natural scientists to develop principles for scientific communication with respect to such policy-relevant assessments that are philosophically defensible, workable in practice, and likely to generate comprehension by relevant audiences."

In essence, Keohane and colleagues (2014) suggest that relevant guidelines for science communicators should be in place due to the ethics involved with communicating science. Although this is a suggestion, at the current time, there is nothing solidified to discuss ethics, or the basis of ethics, with science communication and its communicators.

When examining the larger ethical context in which science communication is situated, namely being influenced from the two disciplines of science and communication, neither field has the same ethical beliefs. Consequently, it would seem that there would be exploration regarding the ethics of science communication and science communicators, since the field takes the majority of its cues from these two distinct fields, but such scholarly exploration is simply not evident. The status of current knowledge in the field of science communication ethics is extraordinarily unexplored, and if it has been explored, there is no mention in the scholarly literature at this time. In fact, there is next to

nothing in terms of previous research, and the *Journal of Science Communication* even has a call for papers on the subject (Goodwin, 2011). This gap in the research is large and identifiable, which is why more exploration has to take place in the area of science communication ethics. Burns and colleagues (2003) cite several scholars agreeing the field of science communication is rapidly expanding, yet the information on the field has yet to expand alongside it. Information on the ethics of science and science communicators should be explored as a basis in the discovery as to what the ethics of science communicators involves, and the discipline of science communication as a whole, to fit the needs of this growing field.

To sum up the basis of science communication, it is apparent that there is lack of concrete definition for the discipline, and that the occupations of science communicators are quite diverse. It is also very apparent that there is lack of information within the area of science communication and ethics that needs to be explored further. At this point in time, the field is growing faster than its research, leaving gaps in the literature that need to be filled and information that needs to be gathered, in order to move forward successfully.

Research Gap in the Literature

It is evident that science communication is emerging as a distinct field, commensurate with increased scientific discovery, science journalism, and public interest. Although science communication is not new, its importance is becoming known as well as the public's perception of science communication. At this time, it appears as though this is a field that is moving at an accelerated momentum, yet not all realms within the field are growing with it. For instance, science communicators are explaining increasingly complex and ethically sensitive notions, but do not having a standard against which to be held accountable for what they say. In this instance, they are relying on

what they think they should communicate, or what they are being told to communicate, instead of an ethical set of norms.

As mentioned after reviewing the relevant literature, it appears that there is a general understanding that science communication requires a stronger basis in ethics with study participants suggesting ethics be an area to explore in the field (Treise and Weigold, 2002). Consequently, the call for papers to discuss ethics in science communication (Goodwin, 2011) suggests that this is also an area of interest to scholars and academics, that needs to be explored further.

Overall, the traditional literature review runs thin in information on science communication ethics, in fact, the lack of relevant literature tells a story of missing information and points to the current situation at hand. The fact that finding studies examining science communication ethics, or the ethics of science communicators, was extremely hard to obtain; therefore, it is important to create a basis of new information. Information that is relevant, current, and appropriate to the research gap—the ethics of science communicators.

To move forward in the literature, the "bigger picture" had to be explored. For instance if science communicators are not using an ethical guideline to make ethical decisions, they must be using their intuitive reasoning, or internal moral compass. When exploring all of the literature, I found science communicators using their own morals for ethical decision-making to be quite intriguing. Although it is quite possible that science communicators follow the ethical guidelines of their superiors, and not their moral ideals, I searched for a philosophical lens of morality—a philosophical lens that would help assess the current science communication ethical situation.

This lack of research involving science communicators and ethics lead to many explorations of ethical theories, but the most fitting is the work of Lawrence Kohlberg and his philosophical theory of moral reasoning.

Theoretical framework

Research Basis

Science communication and ethics, what does it mean and how is it measured? That was the question at the beginning of this study, when determining the process in which the ethics of science communicators could be measured, along with the importance of this type of research to the discipline of science communication.

To begin research into a subject with no apparent solid foundational literature, it was pertinent to start with different theories and philosophies surrounding ethics and ethical ideals in the workplace. Although not much is known about science communication and ethics, Dahlstrom and Ho (2012) claim that the ethics of science communication falls under an umbrella of ethical areas, such as science, policy, and communication, but little has been done to explore science communication ethics further. Aside from the scientific journal asking releasing a call for papers, this is all that is known about science communication ethics at this point in time (Goodwin, 2011). In fact, it reiterates the question as to how science communication achieves a basis for their ethical decision making when there is so much to consider, specifically dealing with the dissemination of important information and how to go about doing so—including methodologies of communication practices and the ethical capabilities of the science communicator themselves.

Consequently, this raised many questions as to if science communicators should be following a code, or if there's an innate sense of ethical and moral responsibility pre-determined within their occupational lives that can be measured. At this point in my research, I decided to focus on the innate moral structures of the science communicator to achieve an appropriate structure for research in this study. Since the study was determined to look at the moral compasses of the science communicator, as their relied source for ethical decision-making in the workplace, the philosophical work of

Lawrence Kohlberg, involving moral reasoning, became prevalent to the study as an appropriate and natural fit.

Based upon the knowledge of previous successful and informative research involving Kohlbergian moral reasoning within business ethics, Kohlberg's work was deemed an appropriate fit to the ethics of science communicators, given its inherent exploratory nature. This study aimed to create a basis in the ethics of science communication and communicators by aiming to determine whether or not Kohlberg's theory of moral reasoning could be applied to science communication ethics.

Kohlberg

Simply put, the work of Lawrence Kohlberg largely focuses on morals and the stages of moral reasoning, which he developed, that resonate with exactly how a person makes decisions based on their moral capacity. Interestingly enough, in terms of applying the ideas of Kohlberg to the context of science communication, how a science communicator solves ethical issues and thinks of ethics issues can potentially be based on their capacity of moral reasoning. This means that their occupational decisions related to ethics are strictly based on their personal moral level instead of an ethically trained perspective. In turn, this idea raised the research question as to if the ethical decisions or responses to ethical dilemmas that science communicators make, correlate and are dependent upon on their level of moral reasoning, or if their actions are separate from their moral compass entirely; specifically, can the psychological methodology and moral reasoning of Kohlberg be applied to the science communicators?

To begin explaining the choice of utilizing Kohlberg's ideas and methods within a communication research study, the work of Kohlberg has to be explained in depth to give an overview of moral reasoning. Early Kohlbergian research is highly influenced, and based upon the

developmental research of Jean Piaget (Weber, 1991). Piaget focused solely on the moral development of children. Kohlberg also chose to begin his research with children, but later expanded his inquiries into adult populations (Kohlberg, 1981).

This area of Kohlberg's research, which was used in this study, chooses to focus on *why* it is that people make the moral decisions that they do, instead of focusing on *what* morals are, and how they are based (Weber, 1991). By taking a psychological approach in to the moral reasoning of why people make decisions, dependent on moral maturity, makes this philosophical and theoretical approach different amongst its theoretical counterparts. Therefore, in Kohlbergian philosophy, the end result over a moral dilemma is not nearly as important as the thought process that lead to the decision.

Kohlberg's Theory of Moral Reasoning is an interesting philosophical and theoretical approach, because it examines the stages of moral growth for a human being. This is unique, because instead of discussing what morals people *should* have and by what age (although stages do have age evaluations as a majority rule), it allows exploration into individual moral maturity. Essentially, two people the same age could have drastically different moral reasoning, and be at different moral stages, opposed to theories with a predetermined knowledge that people know what is deemed *right* and *wrong* by their age. For example, an adult could have the same moral reasoning as a 10-year-old and vice versa. Thus, by focusing on the reasons people make the moral decisions that they do, Kohlberg discovered the stages of moral maturity, and in turn, created his stages of apparent moral reasoning (Weber, 1991).

Kohlberg Explored

Kohlberg claims that we, as humans, will often make different decisions from one another, but have the same basic moral values (Kohlberg, 1981). This is an interesting point to explore, because it

is based on the essential idea that philosophical values of *right* and *wrong* are generally true across the human psyche, but the way in which one thinks about them is dependent on whether or not the person has reached a particular stage of moral reasoning or moral growth. Kohlberg sums this statement up nicely by adding that, "Basic values are different largely because we are at different levels of maturity in thinking about basic moral and social issues and concept" (Kohlberg, 1981). As far as science communication is concerned, this begs the question to if there is a general moral stage of those communicating science and if the complexity of the issues being discussed correlates with a more complex stage of Kohlbergian moral reasoning. To fully understand the moral reasoning of Kohlberg further, and be able to apply the stages of moral reasoning, it is essential to look at his influence, Jean Piaget.

Jean Piaget was a pioneer for cognitive psychology, and worked under Alfred Binet (the pioneer of testing intelligence) (Passer, Smith, Atkinson, Mitchell, & Muir, 2008). During this time, Piaget became interested in how children make sense of the world around them by creating frameworks of understanding. These frameworks consisted of incorporating new experiences into old knowledge and eventually having a new way to experience the world (Passer et al., 2008). Through the exploration of the cognitive development of children, Piaget concluded that there are four stages of cognitive development that a child will experience, called the sensorimotor stage, preoperational stage, the concrete operational stage, and the formal operational stage (Passer et al., 2008). These stages last the child from infancy until twelve years onward where the end outcome is a person who can think abstractly and logically about their surroundings (Passer et al., 2008). Using Piaget's model as an influential guide, Kohlberg, gradually developed stages of moral thought that examine the way children (into adulthood) develop their moral reasoning, much like how Piaget's model shows how cognitive development is established over time (Passer et al., 2008).

In order to develop and test the stages of moral development, Kohlberg created moral dilemmas to test exactly how children and adults respond to situations. By analyzing their responses, and reasons for moral judgment, he then established a range of stages that one goes through while developing their moral reasoning (Passer et al., 2008). Kohlberg's theory of moral reasoning, "…can be defined independently of the specific content of particular moral decisions or actions" (Kohlberg, 1981). The moral stages that Kohlberg philosophized include six stages divided into three overarching levels.

These levels set the standard for his ideologies for philosophical and moral thought and are explained in the chart below:

Level	**General Description**	**Stages of Level**	**Stage Description**
Preconventional	During this time children (commonly aged four to ten) follow the cultural norms of what is right versus wrong, and good versus bad. More or less, this stage is thought of in terms of good being a reward, and bad meaning punishment	Stage 1- The Punishment and Obedience Orientation	This stage involves the physical consequences associated with an action that determine whether that action is considered good or bad. In essence, the child is being obedient and avoiding punishment
		Stage 2- The Instrumental Relativist Orientation	This stage presumes that the *right* action is one of a reciprocal relationship in terms of satisfying one's own needs and the needs of another. Kohlberg refers to this stage as a marketplace in which the seller benefits from selling and the buyer benefits from buying (Kohlberg, 1981).

Conventional	This level is based on the maintenance of expectations set from one's family, group, or nation, even if there are immediate and apparent consequences	Stage 3- The Interpersonal Concordance or "Good Boy – Nice Girl" Orientation	During this stage, good behavior is rewarded, meaning that this type of behavior is one that helps others, pleases others, and is approved by the ones receiving the help as good. Kohlberg notes that during this stage, behaviors begin to be judged based on intention (Kohlberg, 1981).
		Stage 4- Society Maintaining Orientation	This stage is oriented toward authority, rules, and maintains a social order of sorts. The *right* behavior is following one's duty, respecting their authority, and keeping their respective social order in place (Kohlberg, 1981).
Postconventional (also referred to as the Autonomous or Principled level)	In this level, there is an effort to, "…define moral values and principles that have validity and application apart from the authority of the groups or people holding these	Stage 5- The Social Contract Orientation	The fifth stage (social contract orientation) of Kohlberg's moral theory focuses on the *right* action as the one that includes an individual's general right and what society as a whole has agreed to. During this stage, there is a shift from only following authority, to knowing what the stance of authority and law is, but also respecting personal opinion and values (Kohlberg, 1981).

	principles and apart from the individual's own identification with these groups" (Kohlberg, 1981).	Stage 6- The Universal Ethical Principle Orientation	The final, and sixth, stage of moral development (universal ethical principle orientation) defines *right* as, "…a decision on conscience in accord with self-chosen ethical principles appealing to logical comprehensiveness, universality, and consistency" (Kohlberg, 1981). Essentially, this stage is more abstract and more ethical, and less right and wrong, concrete answers (Kohlberg, 1981). The sixth stage is the stage in which an adult (presumably) has reached peak moral reasoning. Although one is supposed to reach peak moral reasoning as an adult, that is not always what necessarily takes place; In fact, some adults never reach stage six in their moral reasoning.

Kohlberg studied humans from their mid-childhood to adulthood, however he found that the majority of adults are static at a stage three or four (the conventional level) in his moral theory framework (Trevino, 1986). In fact, Kohlberg mentioned that he found that less than 20 percent of adults reached the final, principled, level of moral development (Trevino, 1986). This is an interesting notion because this would mean that fewer adults are reaching full moral reasoning as Kohlberg describes. Moreover, the frequency at which adults reach the last level of moral reasoning varies across different cultures (Passer et al., 2008). However, Kohlberg's research is also been shown to be universal across cultures in terms of the hypothetical dilemmas he used in his initial moral theory creation phase (Weber, 1991). So, although not all cultures are perceived to be at the same moral level, the moral dilemmas exemplified resonate universally. Therefore, this also makes Kohlberg's theory appropriate for use in a study, considering participants may be from culturally diverse backgrounds.

The utilization of Kohlberg's Theory of Moral Reasoning has been explored in various settings, and the general workplace is one of them. Seeing as how Kohlberg's theory of moral reasoning has been utilized with participants who currently are in the workplace, it is important to discuss previous findings involving Kohlberg's moral reasoning applied to this type of environment.

Kohlberg Applied in the Workplace

The Kohlberg methodology of moral reasoning has been found effective in researching the workplace, when altered, due to its developmental nature (Weber, 1991). This means that although Kohlberg's method examines those from childhood to adulthood, and is therefore developmental, this method can also be applied and structured to work with adults in the workplace for exploratory use (Weber, 1991). To alter the methodology to apply to the workplace, Weber (1991) used dilemma situations that were of a more familiar nature to his study participants. By including a dilemma that is more familiar to the participants in the workplace opposed to the classic dilemmas used in Kohlberg's

moral reasoning stages (e.g. the Heinz dilemma), it gives the ability to create a sense of familiarity with the interviewee, and potentially elicit a more familiar response to the moral dilemma (Weber, 1991). Specifically, this can help create illicit a response that will closely mimic that of real life instead of a situation less realistic to the participant. In this particular study, it was discovered that when applying the stages of Kohlbergian morals, to ethical dilemmas in the workplace, managers could be assessed for their moral reasoning stage using a scenario that resonated with them (Weber, 1991). Although this sounds idealistic, it is also essential to mention a potential critique that accompanies the use of this theory for research purposes.

One of the limitations of using Kohlberg's moral reasoning stages as a research tool is that the moral reasoning of Kohlberg strictly looks at cognitions and not actions (Trevino, 1986). So, in certain instances the actions of a person and their cognitions may be different and result in actions that do not match their respective moral reasoning stage. This is problematic, because it shows that the ethical actions of an individual may not solely depend on the predictions from their moral reasoning, but instead factors such as a workplace guideline. It has been proposed, however, that an adult's moral reasoning can increase with the evolvement of their career and when individuals are given the chance to solve and be involved in moral dilemmas (Trevino, 1986). So, although people make decisions that are not always reflective of their moral stage, it could mean that they have experienced what makes for the most appropriate decisions to ethical dilemmas in the workplace and repeat those choices.

Overall, the pairing of science communication and Kohlberg's moral reasoning is unfamiliar territory, but the choice seems appropriate when put into the proper context as explained above. This research study looked at an undiscovered area of science communication (ethics), and utilized the current methods of science communicators when dealing with ethical situations—personal morals. The use of Kohlberg as applied to science communication is a different approach—mixing psychology and

science communication studies, but answers the research question as to if the work of Lawrence Kohlberg via moral theories can be applied to the current science communication ethical situation.

In summary, Kohlberg's six stages of moral development give a detailed account of the level of moral reasoning for a participant and have been standing true for many years. Kohlberg's moral reasoning can also be applied to adults, which is a benefit to the particular group of participants in this study. In addition, Kohlberg's moral reasoning has been applied to the workplace previously (Weber, 1991) and has been successful in measuring the moral reasoning of participants in an occupational environment.

Chapter 3- Tests & Methodology

This chapter will explore the methodology and the tests used to conduct the thesis study. The study used two tests, as well as basic demographic questions to gather information from the participants.

Defining Issues Test (DIT)

The Defining Issues Test (DIT) was first used in 1972 and was created by James Rest to measure moral judgment (DIT Manual, 1986). The DIT uses Kohlbergian theory to measure moral dilemmas with a series of six stories, with 12 questions about each story (Rest, 1975). The stories themselves range in dilemmas from stealing medicine for a sick family member to publishing controversial articles in the newspaper (DIT Manual, 1986). The questionnaire is recommended for those over the age of 14, as the wording of the questions can prove to be difficult (DIT Manual, 1986). Additionally, the test is recognized as a accurate way to test for levels of moral reasoning, with the use of at least three of the moral dilemmas in a study, with more used for increased accuracy (DIT Manual, 1986).

The DIT is commonly used in studies instead of Kohlberg's moral reasoning test itself. This is simply because of ease, as Kohlberg's test requires in-person, face-to-face interviews. Along with the use of in-person interviews, Kohlberg's test has a high rate of unusable results, as results must be discarded if a participant fails to answer at least one question in the set (Kohlberg, 1981). This high rate of unusable data, not to mentioned time-consuming way of collecting data, makes Kohlberg's test impractical in this instance, and makes Rest's DIT test more useable for not only this study, but many studies worldwide.

According to Rest (1986), the DIT test is based upon Kohlbergian moral reasoning, but there are four key differences between Kohlberg's test of moral reasoning and the DIT. These include (Rest, 1986):

1. Kohlberg's assessment requires the participant to formulate their own response to problems, whereas the DIT test asks the participant to choose one of the selections provided. The summation of the key difference in this instance being the DIT focuses on recognition of the situation while Kohlberg's test utilizes production of a response.
2. The DIT is more objective in the scoring scheme. Kohlberg's test requires a person to determine what level of moral reasoning the participant is currently at according to a scoring system. The DIT allows the participant to pick his or her own responses and then has guaranteed scoring associated with each response.
3. The Kohlbergian method attempts to determine a developmental sequence to determine the stage of a participant. Although both the DIT and Kohlberg's method believe that there are different cognitive levels, the DIT utilizes a numerical score to locate a participant's developmental continuum.
4. The stages of the DIT and the stages of Kohlberg are very similar, and the DIT relies heavily on the work of Kohlberg, but they are not completely comparable to each other.

That being said, the DIT utilizes a different scheme for determining levels of moral development.

In this study, the DIT was used in an online context, with the all stories and questions from the DIT used to increase reliability. It is important to mention that permission was obtained and purchased to use the Defining Issues Test in the study by the Center for the study of Ethical Development at the University of Minnesota.

Unified Theory of Acceptance and Use of Technology (UTAUT)

In the autumn of 2014, a preliminary research study, on the ethics of science communication was conducted as part of a directed study, in part of the requirements for the Master of Arts, Communications Studies degree at Mount Saint Vincent University. This small preliminary research study involved conducting interviews with science communicators to determine a basis of issues in science communication and ethics. During the interviews, each participant (five in total), mentioned social media as an ethical issue in their job. For instance, the anxiety of posting online and properly representing your organization, or feedback from individuals on you social media page that is not positive. For this reason, the use of social media was measured in this study, but was not the main focus, instead simply an exploratory addition.

The second measure in the study is the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh and colleagues (2003). The measure, although quite different than the DIT, serves its purpose in the research.

This test asks several questions aimed at the acceptance and use of technology as its name suggests. The UTAUT allows questions to be asked regarding technology and the technology to be any technology the researcher sees fit. In the sense of the UTAUT the technology is referred to as the "system" and the research determines what the system means in the sense of the research experiment (Venkatesh et al, 2003).

In the instance of this research study, the "system" refers to social media. Therefore, participants were asked questions such as, "I intend to use the "system" (social media) within the next [blank] months". The questions gauge performance expectancy, effort expectancy, attitude towards using the technology, social influence, facilitating conditions, self-efficacy, anxiety, and behavioural intention to use the system (Venkatesh et al, 2003).

The measure, although quite different than the DIT, serves its purpose in the research seeing as how social media and science communication is a small side note on the overall study. It is a quick questionnaire that has been shown to be successful when compared to other tests of a similar nature (Venkatesh et al, 2003).

Hypotheses

The following hypotheses for the study were determined after researching Kohlbergian ethics and a preliminary, exploratory, directed study. Seeing as how the research is exploratory in terms of the ethics of science communicators, the research hypotheses are general. The general tone of the hypotheses is to explore basic information about science communicators and various effects this has with regard to their ethical reasoning and decision-making.

The first hypothesis is based upon Kohlberg (1976) and his findings that the majority of individuals range in the level 3 and 4 for moral reasoning from his testing experience. Due to this finding, the first hypothesis is:

H_1: The majority of participants will have a moral reasoning level of 3 or 4.

H_0: The majority of participants will have a moral reasoning level different than level 3 or 4

The second hypothesis is that age will be a factor in determining moral reasoning. This is based upon the assumption that as a person ages, they gain more experience in the workplace leading to a higher level of moral reasoning in responding to moral dilemmas (Weber, 1991). Additionally, Kohlberg's ethics show that the beginning stages of moral reasoning start when a person is quite young, and by adulthood his presumption is that the individual will reach a high level of moral reasoning

(Kohlberg, 1976). Therefore, I predict that age will be a factor in the study that is positively correlated with higher DIT scores:

H_2: Age will be a demographic factor that is positively correlated to the participant's level of moral reasoning.

H_0: Age will not be positively correlated to the participant's level of moral reasoning.

The third hypothesis is that work experience will correlate with a higher level of moral reasoning, which was found in the study by Weber (1991). The study showed that in some cases work experience with moral dilemmas causes the individual to learn from previous scenarios and, in turn, gain more moral reasoning in the process. Thus:

H_3: Work experience will be a demographic factor that is positively correlated to the participant's level of moral reasoning.

H_0: Work experience will not be positively correlated to the participant's level of moral reasoning.

The following fourth hypothesis suggests that gender will have an impact on social media apprehension. In the preliminary exploratory directed study, women tended to discuss social media apprehension more than male participants. This hypothesis is based on the preliminary study to see if there is any potential significance, as it may be an area of research interest in the future. Therefore:

H_4: Self-identification as female will be positively correlated to high levels social media apprehension amongst the participant group.

H_0: Identifying as female will not be positively correlated to high levels of social media apprehension amongst the participant group.

Demographics

At the beginning of the study, one of the most important measurements was a brief set of demographic and general questions. The demographic and general questions asked were important to gather the overall basic information from the participants. The questions included age, gender, years of science communication experience, percentage of time spent communicating science, previous ethical training experience and type, and if the participants considers themselves a science communicator or not.

This set of basic questions allowed me to gather a better idea of the population completing the study without knowing them personally, or interviewing them face-to-face.

Data Collection

The data collection process of the study occurred over a period of five months, beginning in autumn 2015. Prior to the study commencing, approval was obtained from the Mount Saint Vincent University Research Ethics Board as well as the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* online course completed, before beginning the research process.

Once the study received approval to commence, the online questionnaire was made live and the participants were recruited via identified science communication organizations. The scientific communication organizations were all found online and were based within Canada. I had no previous

relationships with the participants and did not know them personally. Once a list of participants and emails were compiled, each participant was emailed a participation invitation (Appendix 1)

I deployed snowball-sampling techniques (Bryman, Bell, Mills, and Yue, 2011, 200-201), and in the email invitation, participants were asked to forward the study to any individuals in science communication that would be applicable for the study along with the request for their participation. The basic requirement entailed an individual who worked within the field of science communication, with any given experience, with any background (meaning formally trained in communication or otherwise). This allowed a small snowball effect to take place, gaining participation from across Canada, in various different areas of science communication.

The study itself was quantitative in nature and used an online tool, Qualtrics, to gather the data. Qualtrics is an online survey tool that allows the user to create a variety of different online surveys using various tools (Qualtrics, 2015 version). For example, the user is given the freedom to choose a format for the question such as multiple choice, or text box, to answer the question asked. This tool is therefore excellent for survey design, and allows a comprehensive set of questions to be asked in a feasible manner, while also remaining user friendly. Since the Qualtrics server is stored outside of Canada, an additional survey using the online tool, Fluid Surveys, was created (see Appendix 3). The Fluid Surveys questionnaire, has server storage in Canada, and was strictly used to house the email addresses of those participants who requested further information post study, to ensure that no personal information was both kept in another country or attributable to the main survey answers (Fluid Surveys, 2014).

The online study was compiled using a set of demographic questions, the Defining Issues Test (DIT) (Rest, 1986), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) as described above. All of the measures were entered into

the Qualtrics survey tool using a series of collection methods including: multiple choice, text box answers, and Likert scales (See Appendix 4). The survey also opened with an informed consent that required the participant's permission to participate before beginning the study (Appendix 2).

The informed consent outlined a basis of the study, the length of time for anticipated completion, and information stating that the Mount Saint Vincent University Ethics Board had approved the study. The participants were reminded of their right to withdraw and their anonymity in the informed consent.

The participants were then asked non-defining demographic questions before the DIT questions, and UTAUT questions were administered. Participants were informed that the study would take upwards of 45 minutes to complete and that compensation would not be given for participation.

Chapter 4—Results

The results were achieved over a five-month period beginning in autumn 2015. The study proved to be both challenging and straightforward in the attempts to gather participants. Although finding participants was difficult, feedback was positive from participants who did complete the study, many of whom asked to forward the study to their colleagues in attempts at garnering more feedback in the field of science communication.

Sample

The population of participants required for the study was science communicators. Of this group, the aim was to have respondents of various ages, and work experience, and close to an even split between males and females. Additionally, it was anticipated that the participants would also self-identify as science communicators, as well as having been identified as such by myself. The population of respondents is of course, the goal of the researcher (Beins, 2009). That being said, the true sample of the study did not quite add up to the ideal population. Additionally it must be acknowledged that snowball sampling is distinctly non probabilistic in nature and as such is a sampling/sample frame limitation.

The survey sample was comprised of 37 respondents, 28 of which included usable data for statistical analysis, giving a drop out rate of nine participants, and finally, eight participants answered all questions until the end of the study. The response rate was disappointing after countless attempts at recruiting new participants.

The recruitment of participants was done in several ways. First, participants were found via searches for science communication organizations and then the employees. Through using the online searches, I was able to contact science communicators from across Canada. In the recruitment email, participants were encouraged to forward the email to any science communicator that they thought

would be applicable. From there a small snowball effect took place, but the majority of emails sent were going unanswered. Since the first approach was not as fruitful as I had hoped, I sent out a second round of emails, except I personalized each email instead of using the generic template. This was slightly more effective. After having the study open for a few months with low participation, my thesis committee was contacted and they came to the conclusion that I had exhausted my measures and could close the study.

Although participation was low, it is important to note that not all questions had to be answered in order for the study to be successful; therefore, given the length of the questionnaire, and that the questions were of a mentally taxing nature, it was expected that not all participants would complete the study.

Out of the sample of usable data (the 28 participants), 24 were female (85.71%) and 4 were male (14.29%). Participants were also given the option not to answer the question of gender, however 0 participants selected this option.

The gender distribution of the study is both on par with that of the rising number of female communicators globally (Aldoory, 1998). According to Aldoory, the majority of women in the communication fields are women and that number continues to grow (1998).

Interestingly enough, when communicating with participants who contacted me with names of other potential participants, many women responded with suggests of more female participants, and only very few male participants contacted me at all.

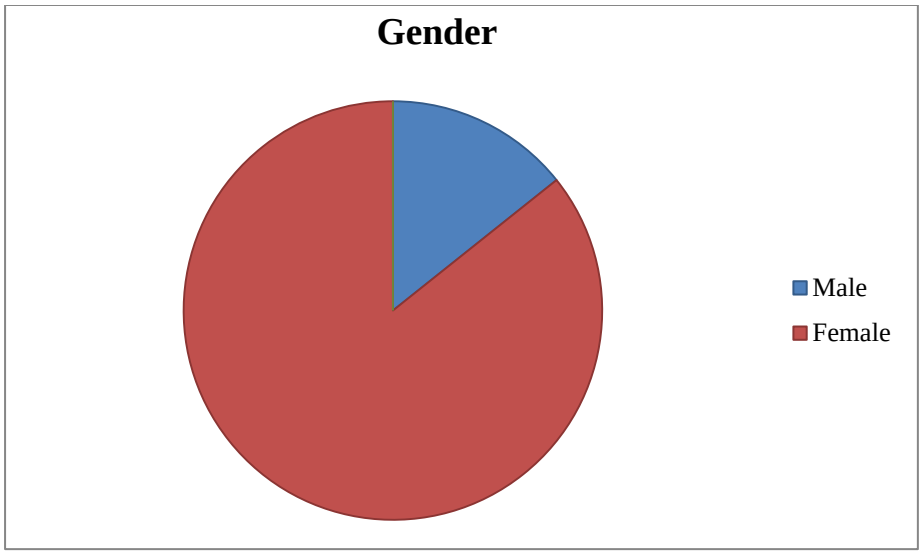

Figure 1. Gender of participants (N=28).

The mean age was 39.64 years, with a minimum age of 18 and a maximum age of 76. This is a good representative sample of those working in the field seeing as how the age range spans 58 years.

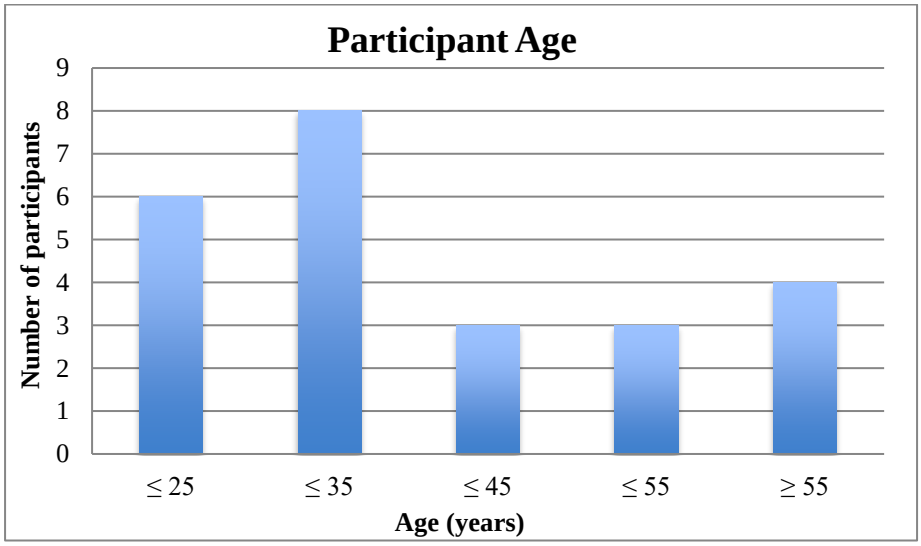

Figure 2. Age of participants within the study.

The majority of participants (71.43%) had 15 years or less experience in science communication, while 28.57% had over 15 years experience, including seven participants (25% or respondents) with over 21 years of science communication experience.

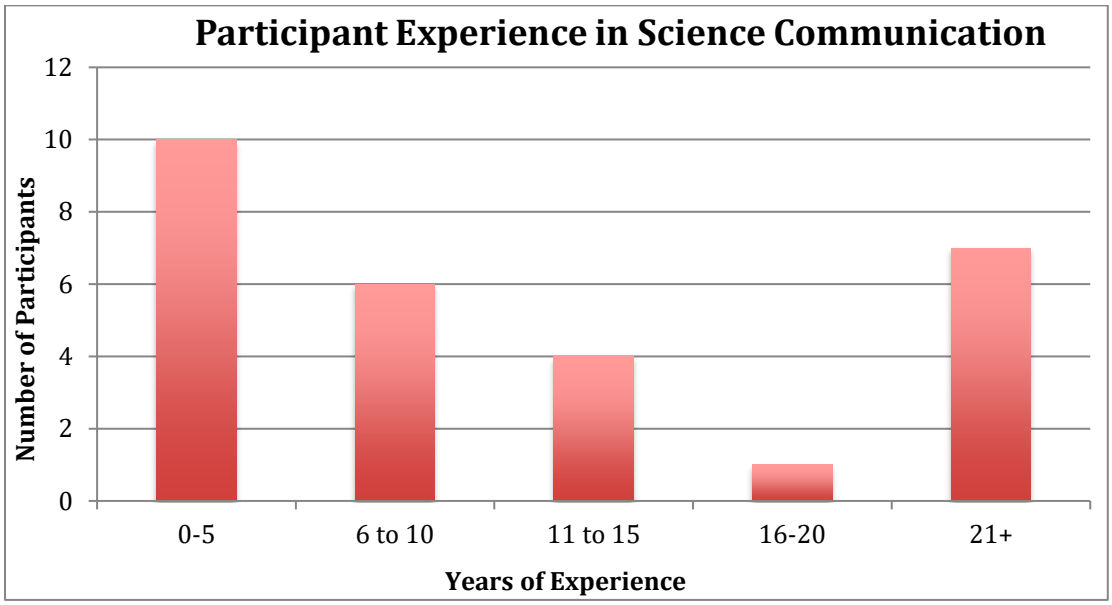

Figure 3. Number of years of science communication experience

The participants were also asked what percentage of their time is spent communicating science, science-based information, and/or science findings. This was an interesting question because participants had to rate their percentage of time based upon their own opinion, and not based on an example of tasks.

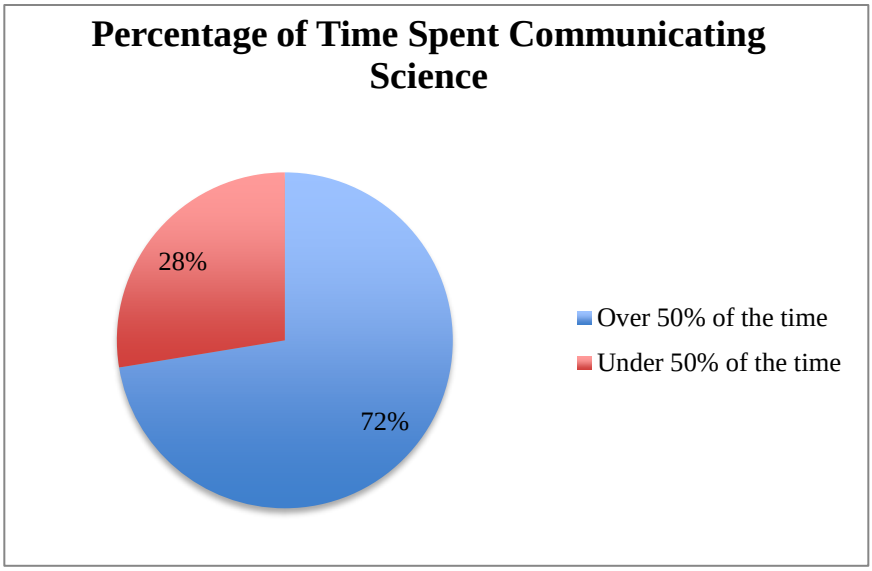

Figure 4. Percentage of time spent communicating science, science-based information and/or science findings (N =29).

Twenty-nine respondents replied to the question with a total average of 58.97% of their time is spent communicating science. This is important because it shows that science communicators are spending over half of their time actually communicating science, whereas some science communication positions can have various factors leaving only a small percentage of time allotted for the actual communication of science.

The next question in the set of demographics was a simple yes or no question. In the literature, it appears that science communicators are very strict in their silos of job descriptors and that some are simply not referred to as science communicators, for instance, there are journalists who report on science, and scientists who share their findings, which reflects a career of a science communicator, but they are either a journalist or scientist first (Thiese and Weigold, 2002). This is interesting seeing as how their job entails science communication, but perhaps the science communicator themselves does not see their career this way, or even identify with the field itself. So, when asked in the questionnaire,

out of 28 participants, 20 said yes they are a science communicator and eight said no they do not identify as one.

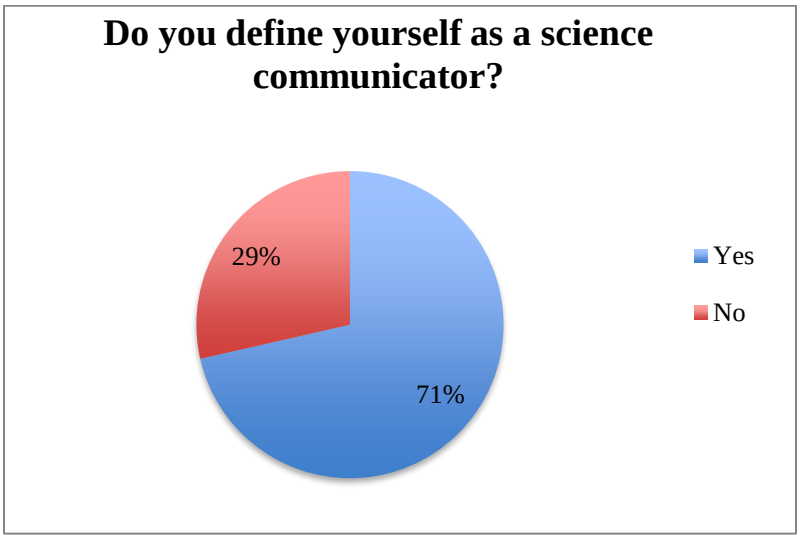

Figure 5. The participants were asked if they identify as a science communicator. In response, 71% said yes, while 29% said no.

The participants were also asked if they had prior ethical training. This was important to ask the sample, because it could determine if they had previous experience learning how to deal with ethical challenges or the situations provided in the Defining Issues Test. Out of the sample of 28 respondents, 13 said that they had previous ethical training and 15 did not. This was a good, and almost even sample, on both accounts.

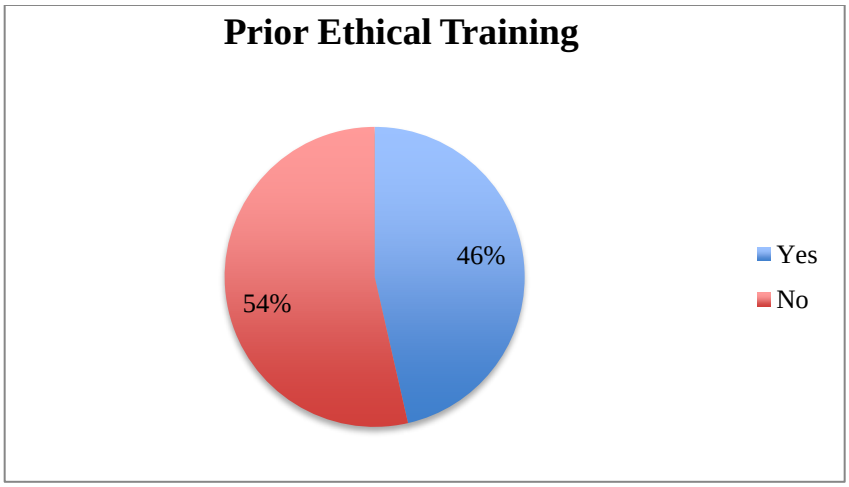

Figure 6. Percentage of participants with prior ethical training (N=28).

The sample was also asked, if they responded yes to ethical training, what kind of training they had previously been given. The options for the participants to choose included: university training, work training, personal (i.e. spiritual), and other (to which they were asked to specify). Out of the participants, 15 responded, however according to the instructions, only 13 *should* have responded. Out of the 15 respondents, 11 said either university or work related training with six for work and five for university, respectively, and four attributed their ethical experience to "other". The "other" responses included reading and being a parent.

DIT Results

The DIT test had mixed results. Although many participants completed the full questionnaire, quite a few read the questions and stopped the questionnaire after the demographics. This was disappointing because it initially looked like more participants had completed the study initially. That being said, out of the participants who had completed the study, I was able to get full questionnaire results.

According to the DIT Manual, the more vignettes answered, the higher accuracy for the results (Rest, 1986). This is good, because it means that the questionnaire is also viable with just one vignette, so if a participant skips one, or decides not to do all of the sections of the questionnaire, their answers

are still valid. This is important because in the results of the study, not all participants completed every vignette.

The results of the study showed overall results that the moral reasoning of the study participants to be higher than the average, with most participants from the sample having the majority of their vignette answers at a level four and above. For reiteration, level four is the level that correlates with the moral reasoning of average adults to practicing medical physicians and is higher than "average"(Rest, 1986).

In order to gauge the level of moral reasoning for participants, each individual is ranked via their choices in the study. The DIT asks participants to read a vignette and then rank 10 questions about the story for importance. Once that is completed the participants are then asked to pick their top four most important details of the story, from the 10 questions above, before moving on to the next vignette.

The system for scoring the DIT only refers to the top 4 choices as determined by the participant in the second part of the question. The scoring system, as shown below, takes each ranking and gives it a corresponding level of moral reasoning as determined by Rest (1986). The ranking is then entered into a separate spreadsheet to be tallied.

STORY	ITEM 1	2	3	4	5	6	7	8	9	10	11	12
Heinz	4	3	2	M	3	4	M	6	A	5A	3	5A
Stu.	3	4	2	5A	5A	3	6	4	3	A	5B	4
Pris.	3	4	A	4	6	M	3	4	3	4	5A	5A
Doc.	3	4	A	2	5A	M	3	6	4	5B	4	5A
Web.	4	4	3	2	6	A	5A	5A	5B	3	4	3
Newsp.	4	4	2	4	M	5A	3	3	5B	5A	4	3

Figure 7. DIT scoring system.

For this portion of the study, I chose to use Excel to track my progress (Excel, 2010). Originally, those administering the test would either score by hand or send their assessments to the DIT lab, which is still an option, but this way it kept me closer to the data.

To score the test, the administrator must use the key code pictured in figure 7. Once the scores are entered into the excel sheet, I included coding to automatically add the amount of scores over level 4, as recommended by the DIT. This gives a percentage of scores at a level 4 and above also known as the P value. The M means that the item is essentially meaningless in the list of choices, and only sounds good to the person who is selecting the choices. In other terms, what sounds like it should be picked in relation to what the participant is reading on the survey. Too many scores with a result of M mean that the participant is trying to appeal to what they think they should be responding to, instead of how they actually would respond, thus meaning the results of that participants score may or may not be of the best results (Rest, 1986).

The letter A score on the test represents an “anti-establishment” outlook on life, and the choice in the questionnaire that condemns expectations (Rest, 1986). This item was originally included as part

of a test from the 1960s, but according to the DIT Manual book, this choice can be disregarded (Rest, 1986).

The test "P" value, not to be mistaken with the *p* value that determines significant correlation between items, should be noted as (signified with a capital P) unique to the DIT. This P value in the context of the DIT is the summation of the ranks given to answers considered to be Stage 5 and 6 items. This means that is a participant answers that their top ranked choice for importance of the vignette was a stage 6 and the third and second rank were 5b and the last rank 3, the participant would have a P value of 9 (stage 6 would have a value of 4, stage 5b would have a value of 5, and the last rank would not have a P score value) as shown in figure 7 (Rest, 1986).

In this study, the P value was automatically calculated via the Excel spreadsheet created for the responses. The P score relates to a higher level of discussion surrounding the morality of social contact, intuitive humanism, and principles of ideal sociocultural cooperation" (Rest, 1986). In the context of this study, the P value represents the level of moral reasoning.

The P score is added by value given to the stages 5A and above as mentioned, and then divided by the number of vignettes used. For this example, six vignettes were used meaning that the P value total, as calculated in the spreadsheet, was divided by 0.6. This number then correlates with a number in the DIT Manual giving a suggested level of moral reasoning (Rest, 1986).

Below is an excerpt from the DIT Manual the accompanied the DIT test (Rest, 1986). It outlines the values of P score and what the accompanied number means for the respondent in terms of their moral reasoning. In a test completed by Rest and colleagues (1986), as referenced in the DIT Manual, the average score of participants was 35, or the equivalent to having moral reasoning between a senior high student and an average adult.

65.2	Moral philosophy and political science doctoral students
59.8	Seminarians in a liberal Protestant seminary
52.2	Advanced Law students
49.5	Practicing medical physicians
42.3	Average college student
40.0	Average of adults in general
31.8	Average senior high student
21.9	Average junior high student
18.9	Institutionalized delinquent boys, 16 years old

Figure 8. P score value and accompanied moral reasoning

After examining the results of this study, the participants had an average P value of ~ 49 with a minimum value of 30 and a maximum value of 66. This is quite intriguing seeing as how that equates the group of science communicators tested as having a higher moral reasoning than the average as found by Rest (1986), and the relative moral reasoning as a practicing medical physician in accordance to the Rest (1986) scale or moral reasoning P score measurements.

Overall, a diverse age range of participants completed the study, and most participants who did participate completed all six of the vignettes. Unfortunately the number of participants was not as great as I had hoped, but those who did complete the vignettes gave quality responses.

UTAUT Results

Unified Theory of Acceptance and Use of Technology (UTAUT) test by Vanketesh et al (2003) looks at the acceptance of a technology that is interchangeable for various technologies and applications. As mentioned previously, the UTAUT asks a series of questions regarding the participant's feelings towards a technology or technological application that is chosen by the person who is administering the questionnaire.

During a directed study in autumn 2014, I conducted interviews with science communicators as a basis of what to look for in my thesis study, in terms of their familiarity with ethics. During this time,

all of the participants mentioned independently that the use of social media in their workplace was prominent and sometimes would cause stressful situations, indicating a sense of apprehension towards the use of social media. This can have various impacts seeing that various social media platforms are key ways that organizations, and in turn, science communicators, now share information.

The UTAUT is designed to fit many technologies by utilizing the term "the system" to interchange with the particular technology the researcher is looking to explore. Questions such as " Using the system is a good idea" and "The system makes work more interesting" are answered in a likert scale (Vanketesh et al., 2003). The questionnaire is based on the work of eight other technology acceptance questionnaires, after all eight were examined in depth in a study by Vanketesh and colleagues (2003). The study looked at the correlations between the studies and based the UTAUT on the essential elements of the already established models (Vanketesh et al., 2003). Coincidentally, there are a few factors that set the UTAUT apart from its counterparts, one of those factors is how the UTAUT is aimed at working professionals as opposed to the other studies that focused solely on students (Vanketesh et al., 2003). This is important since students were not the focus of this study. The UTAUT was empirically tested across six organizations in its inception (Vanketesh et al., 2003). The UTAUT focuses on performance expectancy, effort expectancy, social influence, intention, and facilitating conditions (Vanketesh et al., 2003). It is uncommon to find studies that measure social media apprehension, so that is an additional reason as to why the UTAUT was selected. The UTAUT can be found attached in Appendix 4 for a more in-depth look and list of the questions.

The use of the UTAUT, in this study, had interesting results. The results showed a low response rate with only 8 participants completing the entire questionnaire, but 13 participants started the questions. This was unfortunate, but the UTAUT questionnaire was listed at the end of the study, and as

mentioned previously, the DIT test is quite mentally taxing which may have caused participants to end the study early. Regardless, the results did have an interesting response.

To begin, participants were asked if they use social media in the workplace environment. The participants were given the options to either select “yes”, “no”, or “occasionally”. The responses were quite surprising because none of the participants selected the “no” option for the utilizing social media as part of their career in science communication.

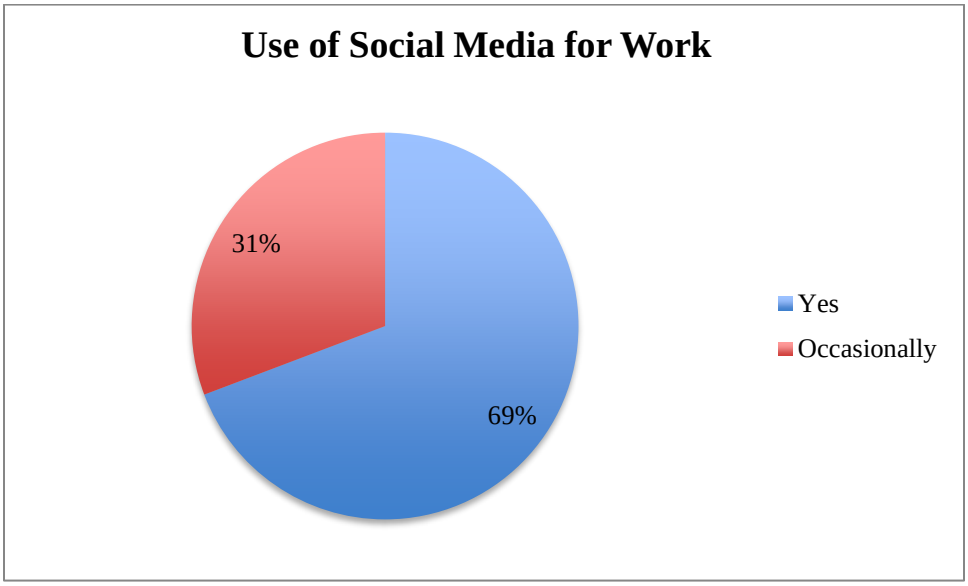

Figure 9. This figure represents how much science communicators use social media for work purposes (N=13).

In fact, nine participants (69.23% of participants) said that they use social media for their science communication occupation (the “yes” option), and four participants said they “occasionally” use social media in their occupation, totaling 13 participants who answered this question.

In terms of the social media responses received, it appears that social media is dependent on an organizational basis; thus meaning that some organizations use various methods of social media (such as Facebook, Twitter, and LinkedIn), while other organizations use one method or none. To avoid leading participants into one form of social media that they may or may not use on an organization

basis, participants were asked to list the three social media platforms that they use on a regular basis in their career and if not in their career, personally. However as mentioned above, all participants said that use social media in the workplace.

The results to the social media platforms used were quite varied, but included: Facebook, Twitter, LinkedIn, Tumblr, Instagram, Pinterest, YouTube, and blogging. It is important to mention that not all participants had three options to list, with some listing one or two social media platforms instead of three. Out of the social media options mentioned, Facebook and Twitter were the most commonly used platforms with LinkedIn as the third most popular social media platform the science communicators are using.

The UTAUT questions were set up on a seven point Likert scale and included a total of 32 questions that explore various aspects of the technology use including apprehension and social media expectations in the workplace. The options for each of the questions ranged from strongly disagree, disagree, slightly disagree, neither disagree or agree, slightly agree, agree, and strongly agree, with the first option on the Likert scale being strongly disagree and the seventh option being strongly agree. The categories of questions are separated into eight groups. The eight groups are: performance expectancy, effort expectancy, attitude toward using technology, social influence, facilitating conditions, self-efficacy, anxiety, and behavioural intention to use the system. The eight categories were chosen from the research conducted by Vanketesh et al. (2003), when they compared technology studies.

After the participants answered their most commonly used social media platforms in the workplace, they were then asked to think about these social media platforms when each of the question sections were asked for the UTAUT. This reminder was put in place to help ensure that participants were thinking consistency of the same social media platforms instead of answering each question about a different social media platform.

The questions showed a warm acceptance of social media in the workplace for science communicators. The question, “I find social media useful in my job” received a mean score of 6.18 with 11 respondents. For reiteration, 7 represents strongly agrees.

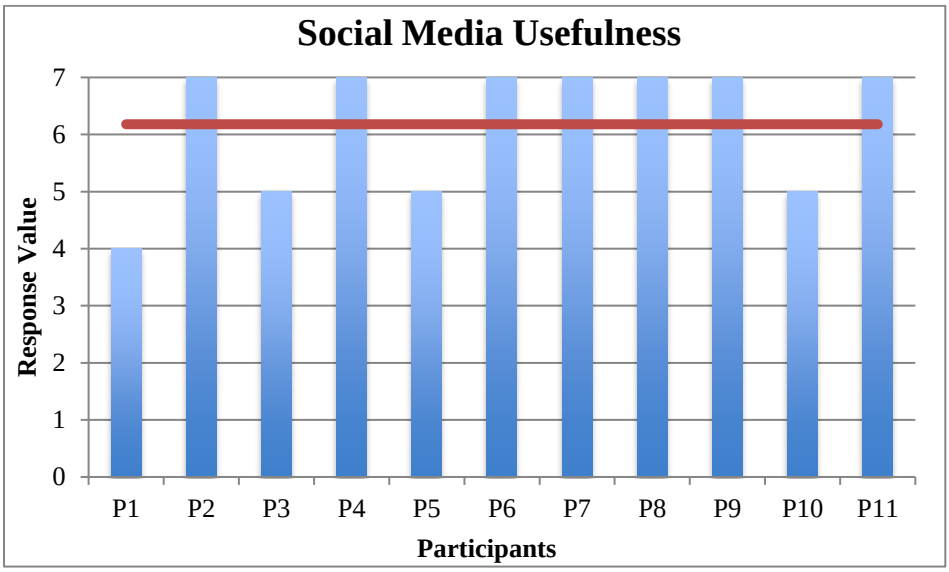

Figure 10. Responses from participants who answered the question the usefulness of social media useful in their current occupation.

This is quite important as the number 6.18 shows that the science communicators who answered the question agree that social media is a benefit to their career. However, participants were quite neutral with the results of the questions, “using social media enables me to accomplish tasks more quickly” and “using social media increases my productivity” with mean scores of 4.38 and 4.17, respectively.

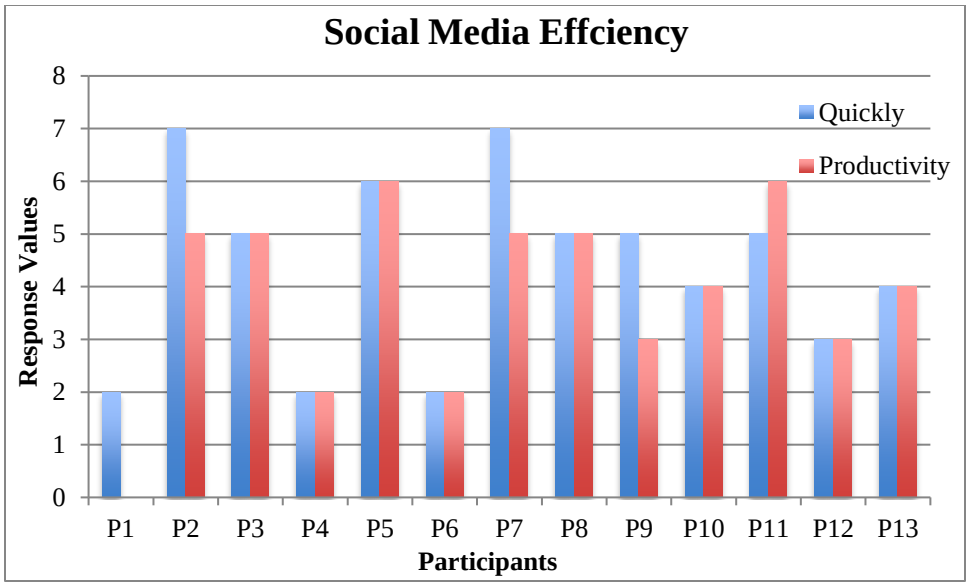

Figure 11. Response from participants regarding if they found social media, in their role as a science communication professional, allowed them to complete tasks quickly and more productively.

The following shows the questions and the results, including the minimum, maximum, and mean scores for the rest of the UTAUT:

Please keep in mind the three answers given as your top three most used social media tools when answering the following questions:

The Likert scale referring to: strongly disagree (1), disagree (2), slightly disagree (3), neither disagree or agree (4), slightly agree (5), agree (6), and strongly agree (7).

Field – Performance Expectancy	Min.	Max.	Mean	Std Deviation	Variance	Count
I find social media useful in my job	4.00	7.00	6.18	1.11	1.24	11
Using social media enables me to accomplish tasks more quickly	2.00	7.00	4.38	1.69	2.85	13
Using social media increases my productivity.	2.00	6.00	4.17	1.34	1.81	12
If I use social media, I will increase my chances of getting a raise.	1.00	7.00	3.18	1.90	3.60	11

Field- Effort Expectancy	Min.	Max.	Mean	Std Deviation	Variance	Count
My interaction with social media is clear and understandable.	4.00	7.00	5.82	1.03	1.06	11
It is easy for me to get skillful at using social media.	4.00	7.00	5.55	0.99	0.98	11
I find social media easy to use.	4.00	7.00	5.64	0.98	0.96	11
Learning to operate social media is easy for me.	4.00	7.00	5.64	0.98	0.96	11

Field- Attitude toward using technology	Min.	Max.	Mean	Std Deviation	Variance	Count
Using social media is a good idea.	1.00	7.00	5.08	1.69	2.84	13
Using social media is a bad idea.	1.00	4.00	2.22	0.92	0.84	9
Social media makes work more interesting.	4.00	7.00	5.36	0.88	0.78	11
Working with social media is fun.	3.00	7.00	5.33	1.31	1.72	12
I like working with social media.	2.00	7.00	5.25	1.48	2.19	12

Field – Social Influence	Min.	Max.	Mean	Std Deviation	Variance	Count
People who influence my behaviour think that I should use social media.	1.00	6.00	4.36	1.67	2.78	11
People who are important to me think that I should use social media.	1.00	6.00	4.27	1.54	2.38	11
The senior management at work have been helpful in the use of social media.	3.00	7.00	5.00	1.22	1.50	12
In general, the organization has supported the use of social media.	4.00	7.00	6.00	1.08	1.17	12

Field- Facilitating Conditions	Min.	Max.	Mean	Std Deviation	Variance	Count
I have the resources necessary to us social media.	2.00	7.00	5.58	1.44	2.08	12
I have the knowledge necessary to use social media.	5.00	7.00	5.92	0.86	0.74	12
The main social media tool I use is not compatible with other social media...	1.00	4.00	2.30	1.00	1.01	10
A specific person (or group) is available for assistance with social media...	1.00	7.00	4.83	1.82	3.31	12

Field – Self-efficacy “I could complete a job or task using social media”	Min.	Max.	Mean	Std Deviation	Variance	Count
If there was no one around to tell me what to do as I go.	2.00	7.00	5.36	1.97	3.87	11
If I could call someone for help if I got stuck.	4.00	7.00	5.50	0.96	0.92	12
If I had a lot of time to complete the job for which the social media was provided	3.00	7.00	5.45	1.44	2.07	11
If I had just the built-in help facility for assistance.	3.00	7.00	5.20	1.33	1.76	10

Field- Anxiety	Min.	Max.	Mean	Std Deviation	Variance	Count
I feel apprehensive about using social media.	1.00	5.00	3.10	1.14	1.29	10
It scares me to think that I could lose a lot of information using social m...	1.00	5.00	3.11	1.37	1.88	9
I hesitate to use social media in fear of making mistakes that I cannot correct	1.00	5.00	2.90	1.30	1.69	10
Social media is somewhat intimidating to me.	1.00	6.00	3.20	1.47	2.16	10

The following set of questions had a 6-point Likert scale with the following values: 1= hour, 2= day, 3=week, 4=month, 5= year, 6= never

Field- Behavioural Intention to Use the System	Min.	Max.	Mean	Std Deviation	Variance	Count
I intend to use social media in the next...	1.00	3.00	2.13	0.78	0.61	8
I predict I would use social media in the next...	1.00	3.00	2.00	0.87	0.75	8
I plan to use social media in the next...	1.00	3.00	2.13	0.78	0.61	8

The results of the UTAUT overall show that science communicators find that social media is useful in their job, but not necessarily the best use of their time in terms of performance expectancy. In terms of effort expectancy, the results all yielded a mean of five and above, showing that the participants in the study found social media easy to use and straightforward. In the same vain, participants found that social media was a good use of their time with all participants agreeing that social media is a good idea and that it is fun. Participants disagreed in this same context that social media is considered bad. This was a result I found particularly compelling as social media "blow ups" in the world of communication, can sometimes mean negative outcomes for individuals and their business.

The next set of questions focused on social influence. This was interesting as this set of questions focused on the outside opinions of others and how the participants felt about the opinions of others in this context. The results of the questions, "People who influence my behaviour think that I should use the system," and "People who are important to me think that I should use the system," garnered results that indicated the participants felt no particular thoughts either way with a mean of 4.36 and 4.27, respectively, for both. Interestingly enough, participants agreed that they are supported

by their organization to use social media. This suggests that although the participants felt no social influence from people who influence their behaviour or people important to them, they felt that it is important to their organization.

In terms of self-efficacy, the participants agreed (with answers about 5—slightly agree) that they could competently complete the tasks of social media without assistance, and that help would be available if needed.

Next questions were asked regarding social media anxiety, which is the most interesting to this study. As previously mentioned, in an exploratory study, science communicators expressed anxiety towards social media in a qualitative setting, so I was very interested in seeing what kind of responses would be gathered in a different format. In all responses, there were a few participants who responded that they feel anxiety towards social media. Consequently, the majority of the results, or the means, showed different.

For the results of all of the anxiety questions the mean responses were that of a level 2 or 3. Thus meaning that participants disagreed or slightly disagreed with the questions of anxiety, which included,

- I feel apprehensive when using social media;
- It scares me to think that I could lose a lot of information using social media by hitting the wrong key;
- I hesitate to use social media for fear of making mistakes I cannot correct; and
- Social media is somewhat intimidating to me.

These results were contradictory to the preliminary exploratory study, so that was quite interesting.

Finally the UTAUT asked participants on their intention to use social media in terms of frequency of use and all results in the 2 range meaning that participants plan on using social media

within the next day. This shows that social media is ingrained in the lives of this group of participants and should be a focus of future research. In this study the purpose of the UTAUT was to further explore this issue with science communicators, as an extra measure, but I think that it is an issue that can go forward as its own realm of research.

Hypotheses Explored

The study aimed to garner results based on the four hypotheses asked. Considering that there have been no prior studies on the subject, the hypotheses were very neutral in nature. In fact, this lead to being quite a challenge because there are many unanswered questions regarding the science communicator world and ethics, however not enough time to explore all of the facets.

The purpose of the hypothesis questions was to gain insight on areas that can be examined further in the world of science communication and ethics in future studies that could perhaps becomes studies of their own in the future.

The study results were varied in age, experience, whether they science communicators identified as such, and if they had ethical training. Unfortunately, out of the sample, only two men completed the study versus the 15 women who completed the study. This left a large bias towards women in the study as the results were skewed 15 to two. Out of the 17 participants in total who completed the study, most completed the entire set of vignettes, however a few completed less. This was unfortunate, as more respondents would have given more robust results. After leaving the entire study open for five months, it was decided by myself, and my thesis committee, that I would end the study with the amount of participants who completed the study. At the beginning, the study showed great interest, but the amount of people who actually participated was a small sample. I tried many techniques to get more participants, including individualized email requests, but without any incentive to participate, the study had a standstill of participation.

One of the most significant perks of using the DIT as the main test was that the test allows for varying degrees of vignettes used. This means that responses can be achieved using one vignette or all vignettes. As it is recommended by the DIT (Rest, 1986), that the more vignettes used, the more well-rounded responses, so six vignettes were included. Unfortunately, not all participants completed all of the vignettes, but their DIT score is tabulated on a vignette-by-vignette basis, not if they complete all of the DIT parts of the study. So, to ensure that the study used the maximum amount of participant data possible (seeing as how participation overall was low), all participants of varying degrees of completion of the study were included. If the sample was bigger, this issue would have been investigated further and those with partial completion may have been eliminated from the total sample.

To begin the calculations, before the hypothesis was tested, the mean scores of male and females who participated in the study were tabulated as a basis. In this study, 15 women participated and two men. The proportions of these two groups are quite different, so the mean scores were tabulated to equal proportions. The mean score on the DIT test for female participants was 49.33 and the mean score for male participants was 47.5. Both of these scores are in the 4^{th} quarter percentile meaning high moral reasoning.

To test the hypotheses a series of tests were completed including chi square tests for significance (p value of < 0.05). As previously mentioned, the P scores of all participants who competed DIT vignettes were calculated. The P score (to be noted as different than a p score), reflects a level of moral reasoning.

The first hypothesis of the study was:

H_1: The majority of participants will have a moral reasoning level of 3 or 4.

H_0: The majority of participants will have a moral reasoning level different than level 3 or 4.

Although the P scores (calculations explained earlier) do not reflect an exact mirror of the levels of Kohlberg, the principles are based on Kohlbergian ethics. For instance, the first stage of Kohlbergian ethics would resonate with the score 18.9 or lower on the P scale for DIT, which DIT claims is, " Institutionalized delinquent boys, 16 years old". As the DIT is meant for those at adult ages, Kohlberg's moral reasoning and the DIT do not match age timelines.

As previously mentioned, the mean score for the respondents of this study was 49.11, with a maximum score of 66 and the lowest score being 30. This puts the majority of science communicators at the same level of "practicing medical physicians" according to the DIT (Rest, 1986). That level of moral reasoning is most similar to a high stage 4 or lower stage 5 of the Kohlbergian moral reasoning scale, based on the bottom of the DIT scale being a stage one and the top of the scale being a stage six.

According to the DIT reference sample, the average P score is 35, and most studies do not find scores above 50 (Rest, 1986). Therefore, according to Rest (1986), this puts the mean results of this study in the 4^{th} quartile, or high development in moral reasoning. Since the hypothesis is shown to demonstrate a high level of moral judgment, and not an "average" level of moral judgment that would resonate with a stage 3 or 4 in Kohlbergian ethics, the results therefore show that the science communicators in the study have high moral judgment. High moral judgment has a strong correlation with stage 5 in Kohlbergian moral reasoning where an individual is aware of law, but also can incorporate personal opinion into their moral reasoning (Kohlberg, 1981).

When calculating significant for a statistical difference between the expected mean (M=35) per

the DIT test, and the actual mean of DIT scores (M=49.11), a one-tail t-test was calculated. The results expressed a significant p value, however the p value was extremely small. Although this indicates a p value less than 0.05, it may be too small to credit.

T TEST	
hyp mean	35
sample size	17
mean	49.11588235
std dev	11.16626452
effect size	1.264154394
tails	2
std . Error	2.708216944
df	16
tstat	6.646439475
pvalue	**5.61643E-06**
alpha	**0.05**
sig	**yes**

However, due to this finding, and the fact that when scoring the DIT, the results were in the 4th quartile, the hypothesis is rejected and the null hypothesis accepted.

The second hypothesis to be explored in the study explores age and moral reasoning. Since with age, moral reasoning can change, the second hypothesis states:

H_2: Age will be a demographic factor that is positively correlated to the participant's level of moral reasoning.

H_0: Age will not be positively correlated to the participant's level of moral reasoning.

The results of the age groups and the mean scores per group, were not as expected. In fact, the distribution of the scores showed those in the 36 to 45 age range, and the 55 and above age range, having lower scores than the other three age groups. This does not coincide with the expected results.

To determine correlation, a linear regression was conducted. This method was chosen to

determine if a strong correlation coefficient (R^2) score could be found between participant age and mean DIT score to determine if age was correlated with a participant's level of moral reasoning. The closer the R^2 score is to a value of 1, the higher the correlation between the variables.

The following graph was created in Excel and shows the five age groups (Age groups: 1= 18-25, 2= 26-35, 3=36-45, 4= 46-55, and 5= 55 and above). The correlation coefficient, the R^2 score is 0.0174. This score means that the data is not correlated.

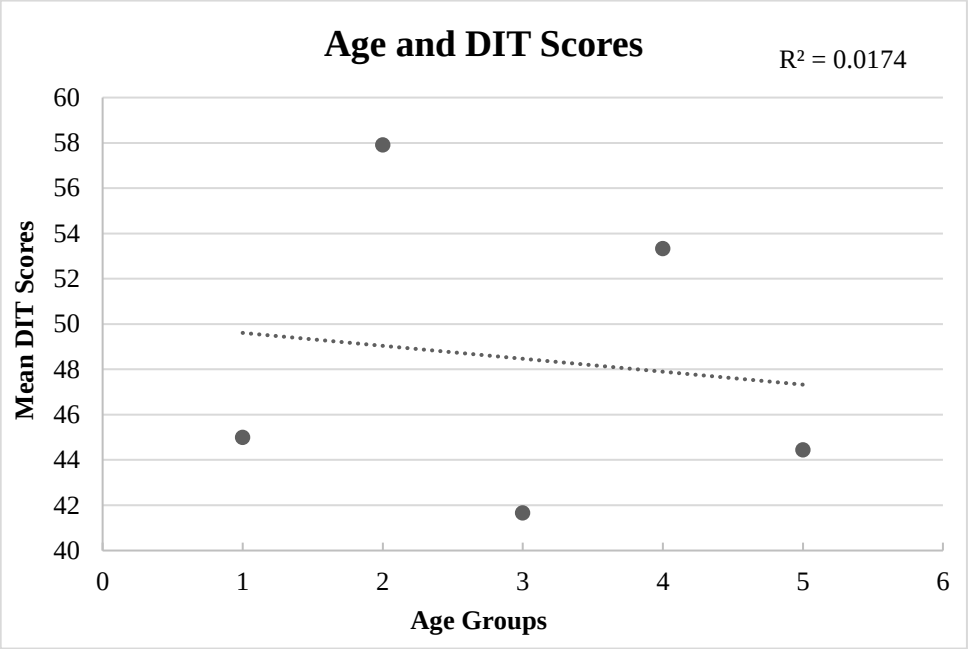

Figure 12. Mean DIT scores versus age groups

Since the correlation coefficient is very weak, the hypothesis is rejected and the null hypothesis, that age is not positively correlated to the participant's level of moral reasoning, is accepted.

The third hypothesis involves work experience and the participants level of moral reasoning:

H_3: Work experience will be a demographic factor that is positively correlated to the participant's level of moral reasoning.

H_0: Work experience will not be positively correlated to the participant's level of moral reasoning

To determine if there is a positive correlation between work experience and DIT scores, a linear regression was conducted. The levels of experience were broken into five intervals, 0-5 years, 6-10 years, 11-15 years, 16-20 years, and 21 and above years. It is important to mention that there were no participants in the 16-20 year experience range with usable questionnaires.

The following graph was created in Excel and shows the four experience groups (Experience groups by years: 1= 0 to 5, 2= 6to 10, 3= 11 to 15, 4= 21and above [experience group 16 to 20 years was omitted due to lack of data]).

Figure 13. Experience in science communication versus DIT scores

The correlation coefficient, the R^2 score was 0.0754. This score barely shows a correlation in the positive direction. Since the correlation score is so low, it is safe to say there is no correlation between experience and DIT scores (measure of moral reasoning) in this study and the hypothesis that work experience will be a demographic factor that is positively correlated to the participant's level of moral reasoning is rejected and the null hypothesis accepted.

To explore this further, an additional analysis was added to this data. In particular, I was curious to see if years of experience and whether the participant identified as a science communicator

themselves effected their DIT score, or level of moral reasoning. To test this additional question I completed a Chi square test in Excel for a p value.

Observed:

Science communicator and years of experience					
	0-5	6 to 10	11 to 15	21+	
yes	47.8	43.3	66	46.6	203.7
no	54	48.3	50	60	212.3
	101.8	91.6	116	106.6	416

Expected:

Science communicator and years of experience					
	0-5	6 to 10	11 to 15	21+	
yes	49.8	44.9	56.8	52.2	203.7
no	52	46.7	59.2	54.4	212.3
	101.8	91.6	116	106.6	416

Chi Square p value: 0.225

After doing the calculations in Excel, the p value was 0.225. This value shows no significance, meaning that there is no relation between whether a participant identifies as a science communicator and science communication experience is related to their moral reasoning scores.

The fourth and final hypothesis was:

H_4: Gender will be positively correlated to high levels social media apprehension amongst the participant group.

H_0: Gender will not be positively correlated to high levels of social media apprehension amongst the participant group.

One of the UTAUT questions specifies anxiety and “the system”, which in this instance, is social media. Out of the 17 participants, 10 completed this question in the questionnaire with nine females responding and one male. Ideally, the number of males and females answering the question would be significantly larger and of more equal proportions.

To make the sample more proportionate, I calculated the mean scores for the female participants. The four questions for the anxiety portion of the study were:

- ANX1: I feel apprehensive about using social media;
- ANX2 It scares me to think that I could lose a lot of information using social media by hitting the wrong key;
- ANX3: I hesitate to use social media for fear of making mistakes I cannot correct; and
- ANX4: Social media is somewhat intimidating to me.

The Likert scale by which these were measured ranged from 1- 7 with the scale being: strongly disagree (1), disagree (2), slightly disagree (3), neither disagree or agree (4), slightly agree (5), agree (6), and strongly agree (7).

The mean scores for the females and male who completed the study were:

	Female (mean scores)	Male (mean scores)
ANX1	3.11	3
ANX2	2.77	3
ANX3	3	2
ANX4	3.33	2

To test for significance, a Chi Square test was completed. Once the observed and expected values were calculated, the p value was determined.

Observed					
	ANX1	ANX2	ANX3	ANX4	
Male	3	3	2	2	10
Female	3.11	2.77	3	3.33	12.21
	6.11	5.77	5	5.33	22.21

Expected					
	ANX1	ANX2	ANX3	ANX4	
Male	2.751013057	2.597928861	2.251238181	2.399819901	10
Female	3.358986943	3.172071139	2.748761819	2.930180099	12.21
	6.11	5.77	5	5.33	22.21

The p value, to determine a significant correlation between gender and social media anxiety, was 0.955. Since the p value is > 0.05, there is no significant correlation between gender and social media anxiety, thus rejecting the hypothesis and accepting the null hypothesis.

In summation, the first hypothesis, **H_1: The majority of participants will have a moral reasoning level of 3 or 4** was found significant, but the remaining three hypotheses were rejected and the null hypothesis accepted (in bold):

H_2: Age will be a demographic factor that is positively correlated to the participant's level of moral reasoning.

H_0: Age will not be positively correlated to the participant's level of moral reasoning.

H_3: Work experience will be a demographic factor that is positively correlated to the participant's level of moral reasoning.

H_0: Work experience will not be positively correlated to the participant's level of moral reasoning

H_4: Gender will be positively correlated to high levels social media apprehension amongst the participant group.

H_0: Gender will not be positively correlated to high levels of social media apprehension amongst the participant group.

Chapter 5—Discussion

At the beginning of the study, it was noted that the field of science communication is vastly unexplored, and in fact, this still remains true. Science communication is a unique area of communication and an area that deals with complex issues that can be of a unique ethical nature (for example the newest, edgy, scientific discovery). It is my strong contention, as a science communicator myself, that it is extremely important to continue to explore the field and continue to push the boundaries on research in the area. As this study was a preliminary and exploratory study, and being that science communication on its own has not been explored extensively as a distinct discipline, it has created a basis for future studies to grow, along with my research.

The research study utilized psychology and communication to discover more about a field that is less studied, which is a different combination of individualize fields for this area of research. When starting with a seemingly blank canvas of prior research, it is hard to determine where to start. I think this was a good choice as a study, in terms of personal interest, and the field as a whole, because psychology and communication are intertwined on varying levels.

The philosophical underpinnings of the study, Kohlbergian moral reasoning, have been around for a long time, but that does not mean that it was irrelevant for this study. It is not the traditional choice for a communication research study, but ethics, and communication are two intertwined areas. Essentially, communications must be preempted by a moral thought of why an issue is being communicated and what to say or do for the communicative message. Kohlberg focuses on the *why* people do what they do instead of the *what* they do, and in turn, the answer they end up with (to a morally challenging situation), in terms of their moral reasoning. The levels of moral reasoning, all six levels, are complex, but so is the process of making the decision. The decision-making process is just as difficult, or more difficult, than the decision itself.

The results of this study showed that the level of moral reasoning for participants is a high level four in both Kohlbergian moral philosophy, and the Defining Issues Test. This is a higher than average result for both tests. This means that science communicators, when challenged with thought-provoking substance, are thinking through the moral outcomes to get their end result with a higher level of moral reasoning than the average. It also points towards the fact that when dealing with sensitive, or morally aware, information, science communicators are approaching the situations at a higher moral level than that of the average person. There are many reasons as to why this may be true, but working in a field full of complex and difficult information, and have the ability to respond with an ethical candor, the science communicator must operate a higher level of moral reasoning, or at least garner more experience dealing with ethical situations.

The results of the study also showed that age and work experience also do not matter when it comes to making an ethical decision and the level of moral reasoning that coincide with that. This fits with Kohlberg's reasoning as an individual can have the same moral reasoning as someone younger or older, and that is independent of moral reasoning itself. In essence, someone who has high moral reasoning may have high moral reasoning despite his or her age or experience. This is interesting, and somewhat unexpected, but if one reflects on the idea that an individual may stop progression at age 15, yet another individual who is younger than age 15 progresses further that the first individual, age is simply a number and not a determining factor. The same goes for experience. Although an individual may go up a level of moral reasoning in time, another individual may remain at the same level forever despite many opportunities to garner more moral reasoning experience in their lifetime.

With all Kohlbergian philosophy in mind, it is possible that science communicators are drawn to the field, and excel in science communication, because they possess a higher level of moral reasoning for communicating difficult and ethical issues. Quite frankly, if science communicators failed

to accurately encompass ethical science issues, the field would not be seeing a surge in importance or popularity that has become common place in the past decade.

In this instance, and in terms of this study and its logistics, the use of the Defining Issues Test (DIT) allowed moral reasoning to be measuring in a format that was user-friendly, and allowed the study to be completed online. This was particularly important as the goal to reach science communicators across Canada would have been extremely hard, not to mention time consuming and costly, if face-to-face interviews had to be conducted. Additionally, the use of the DIT allowed for participants to have varying completion rates of the study, but still have valid responses. This was extremely important to this study, as the response rate was low to begin with. On top of the low response rate not all participants responded to every vignette. If the participants with a lower response rate had not been included the overall response rate would be even lower, leading to worse calculations and results.

Finally, the inclusion of the UTAUT study was based on the preliminary research, however studies surrounding the acceptance of social media are still relatively hard to find. The UTAUT by Venkatesh et al (2003) explored the various areas of a technology. As this was an issue brought up by current science communicators in the preliminary study, it was a good fit.

Overall, I am happy with the basis of the study and the type of study completed, however, as with any study, there are also limitations, as well as further ideas moving forward.

Limitations

The results of the study, overall, were low on the basis of participation and therefore limited. As mentioned at the beginning of the study, after many months of attempting to garner new participation from science communicators across Canada, only 37 participated, and in turn, only 17 completed the study with useable data for the DIT measure. This was opposite to the original plan even though it

included a snowball effect of participation. Participants were encouraged to forward the study to other science communicators that they knew in the research invitation, and I invited science communicators from across Canada to participate by emailing them cold. The response rate from the emails varied, but I was surprised to see the response rate as low as it was.

The low participation rate means that the results of the calculations, whether significant or not, are not strong. Ideally, the study aimed to have 130 participants, which would have given more statistically sound results. Although there was significance found in terms of the science communicators having a higher level of moral reasoning using Kohlberg's results (1981), I would not rule out this as an extremely significant finding on a numerical basis, as the sample size was far too small, however it should be explored further. The sample size of science communicators was diverse in age range, and experience, but not in gender and overall size. In continuation with limitations of the study, a more diverse sample would have given more robust results.

Additionally, the measures used to get results, the DIT and the UTAUT, are not new measures by any means. To clarify, the measure does not have to be new, to be statistically sound, however many of the questions in the DIT were greatly outdated. I attempted to change the language when deemed inappropriate for today's culture, but could not change the basis of the questions. Due to that, the questions sometimes require two or three reads before complete understanding is established. Ideally a newer version of the DIT, if available, would make measuring moral reasoning more up-to-date with relatable vignettes for our current cultural norms. In that vane, the UTAUT was also created in 2003. Technology wise, this is a long time ago. At the time of inception for the study, measures for social media apprehension were very few and far between, and the UTAUT is a good general choice, however it can span various different technologies. If the study were to be recreated, it would be beneficial to

seek out a study that was specifically designed to measure aspects of social media and apprehension, as social media has since become ingrained in North American culture.

Moving Forward

The idea of the study was grand but the reality was on a small scale. Needless to say, there were still parts of the study that could be explored further.

To begin, I think that if the study were to be conducted on a larger scale, with more science communicators, that it would have more interesting results. I think that it would be wonderful to see the study completed with a more representative sample to gain a basis for research in the field.

Secondly, one of the most important questions, and the question that found significance was the level of moral reasoning in which science communicators in Canada currently have. This aspect of the study could be explored more in-depth in the future and would make for an interesting study on its own, particularly to see if the results still hold strong with a larger sample.

Additionally, the majority of participants were female. I think that this result, and the result above (higher level of moral reasoning), could be correlated, although it goes against both the findings of Rest (1986) and Kohlberg (1975). This would make for an interesting hypothesis within the sample of science communicators if a larger, and more diverse, gender sample was available.

Finally, a mixed-methods study may be beneficial in this instance. As Kohlberg (1981) found results using face-to-face methods when measuring moral reasoning, I think that there would be potential in finding out, qualitatively, why science communicators answered the questions the way they do and also find out the typical moral and ethical issues they deal with on a daily basis in their career. I think by exploring the current issues they are facing, it would create more depth to a similar study and add to the unfolding research in the discipline, while still having a lens on ethical and moral reasoning.

Personal Reflection

Ethics and science communication, in my opinion, is a grey area. From my philosophical standpoint, science communication and ethical decision-making is not particularly unique in the sense of *right* versus *wrong* when recognizing a situation itself, but being able to use ethical judgment to determine future outcomes. For instance, it involves being able to use moral reasoning to determine an action and reaction to a situation that may be hypothetical—not always a situation currently presenting itself. When communicating science, sometimes the communicator is using their ethical and moral reasoning for an outcome that is not fully explored, meaning that the science communicator must project their moral reasoning and make a judgment based on the unknown. To do this successfully and have a career in the field, I think that science communicators generally have average to higher than average moral reasoning as a basis, and additionally, an understanding of moral philosophy in general, as found in the study.

However, even with the assumption that having a higher level of moral reasoning means making ethically better decisions, I do not think it always equates that way. In fact, with many scenarios of an ethical context, the decision that has to be made is not always without issue. The conflict between moral limitations and job limitations make any career difficult, which can also hinder full philosophical potential. Thus meaning, there are extraneous factors involved in any situation such as job security and monetary compensation that make ethical decision-making difficult. Although Kohlberg would suggest that the highest level of moral reasoning would mean that making the proper moral decision would come above job security and money, I feel that perhaps the relationship between consequences that can negatively impact one’s life, and making a moral decision, is not so black and white. Behaving in an ethical manner can involve third parties, such as an employer, and making the ethical decision may not be the popular choice.

In science communication, behaving ethically may involve going against your employer and risking money. It also may mean disagreeing with the masses. Science and morals do not always mesh. Science pushes boundaries, which can be uncomfortable, so I think that being a science communicator means that you have to be comfortable pushing boundaries and accepting the risk that comes along with it, and the moral decision-making. This risk can involve public backlash to a news release, to complete and utter protest. However, to change the way that scientific events evolve, risks will occur, and change must happen to push boundaries.

The future in science communication and ethics will continue to be a grey area with continuous ethical decisions, and in fact, I do not see this changing anytime soon. This means that science communicators must fully know their information as a basis to make informed ethical decisions. Science involves believing and trusting knowledge and new facts, sometimes things that cannot even be seen with the human eye. This is not easy and sometimes involves idealisms and viewpoints of how the world has always worked, and how that way must change. It means that ethically, you have to make decisions on cutting-edge discoveries and to make these decisions, it involves a higher level of understanding and moral reasoning to make decisions beyond what is directly in front on you and forecast the future. Science communicators must know that not everyone will agree, and at times, being ethical may be an uphill battle.

That being said, with things sometimes against forward motion, I feel that the future of science communication and ethical decision-making is headed in a forward direction, with science pushing the change in moral decision-making nonetheless. Technology is changing the landscape of science, how people communicate, and what people can do. Consequently, I do think that science will change the landscape of moral principles. For instance, as technology becomes better and old ways are left behind, it begs the questions as to if old ways become seen as immoral? As new discoveries are made, will the

old way of thinking be considering ethically wrong? Trusting ethics sometimes means trusting things that you cannot see and basing moral decisions off of issues bigger than the world itself, and scientists are behind the movement. This factor is the importance of ethical beings, making the ethical decisions.

This movement, I feel, does not settle well with many people because the unknown can be scary and perhaps it is even scary for science communicators. Using a moral compass to direct the masses is a huge responsibility. News stories spouting false facts, or misunderstood studies can create doubt in the minds of the public and their thoughts on science. This is why science communicators, to be great at what they do, need to be morally advantaged to make decisions on what is best to communicate to the public. False news stories and bad science can make a harder job for science communicators. For example, the autism and vaccination article that was published in a scientific journal suggesting that vaccinating your children created autism. This fear-mongering article put distrust in science and has left science communicators picking up the pieces, for years, talking about the big implications of not vaccinating your children and stopping the spread of false science.

The phenomenon of “fake news” spreads quicker than that of the truth. “Fake news” is catchy and attention-grabbing propaganda—it is also something that science communicators must combat. It means, to me, that those scared of change know that change is happening and claim “fake news” to scare the masses. It is a side effect to uncertainty, and disbelief, which is why it is important to have skilled scientists, and science communicators as a sounding board for the public to trust, to make ethically advanced moral judgments for all. These moral judgments, and all of the ethical decision-making despite public contempt and uncertainty in science communication careers is why I continue to be interested in this field of research and why I think that it needs to continue to be explored.

Chapter 6—Conclusion

In summation, the aim of this study was to create a basis for those who are teaching science communication, learning science communication, and working in science communication to garner the introductory ethical stances and level of moral reasoning of others in the field in which they are involved, a better overall understanding of science communication, and a basis for studies to come. With the infiltration of dedicated university- level science communication programs in Canada, it is important to gain as much information to better educate the learning, teaching, and practicing publics about their discipline while potentially initiating and inspiring further research in the area. Although the study is designed to render a basic knowledge of science communication ethics and the moral stages of science communicators, it is a start in the right direction, and the beginning of new and exciting research in the field.

The main research question going into the study asked if Kohlbergian philosophy of moral reasoning could be applied to science communicators. The results of the study show that, yes, Kohlbergian philosophical thought or moral reasoning can be applied to science communicators, as completed in the study. The DIT test measured the moral reasoning of participants and helped determine the level at which science communicators currently in the field are assessing ethical situations. This level, according to the results, is higher than the average conclusions of Kohlberg, and the DIT test. This fact in itself is interesting, and would most definitely be worth exploring more in the future.

The results of the study show that more needs to be explored within science communication and that there is a hint of significance to make further exploration worthwhile. The notion of science communication and ethics are both two distinct areas that are bigger than the definitions themselves. These complex fields are both important and should be studied extensively regarding their relationship

together, specifically because science communication occurs at a rapid pace. Science communicators are battling “fake news” phenomena and tough issues, and how they deal with those scenarios is, quite frankly, interesting.

At the end of the day, science communicators are dealing with ethical situations, and trusting their own moral compass to make the decisions. The moral level at which these decisions are made can, in turn, have long-term effects on the field, the science, and the communication surrounding the public and science communicators globally.

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Appendices:

Appendix 1—Email Invitation for Participation

Mount Saint Vincent University

Department of Communication

Halifax, Nova Scotia

Research Invitation

Ethics in Science Communication

Primary Investigator: **Dayna Bell (Master of Arts Communication candidate)**

Research Supervisor**: Dr. Anthony Yue, Dept. of Communications, MSVU**

Emails: [redacted]

Anthony.yue@msvu.ca

Phone: Dayna- [redacted]

Tony- (902) 457- 6244

You are invited to participate in a research study. The primary investigator, Dayna Bell, is exploring the current pragmatic, and ethical, stances of those working the in the field of science communication, and would greatly appreciate your participation. This is a vastly unexplored area of research, and more information is needed to garner a basis of ethics in the science communication field.

This one-part study will involve an online questionnaire that will take approximately ***45 minutes*** of your time. The questionnaire will take place during the summer of 2015, at your convenience. All responses will be completely confidential, and participation is strictly voluntary. There is no significant risk involved in this study, and if for any reason you wish to discontinue, you can do so at no penalty.

If this sounds interesting to you, and you would like to find participate or find out more about the research study, please contact Dayna Bell. Dayna is available by either email or phone to answer any questions at the contact information provided above.

If you would like to begin the study now, please follow the link: http://www.qualtrics.com/[redacted]

Dayna is currently completing her thesis, at Mount Saint Vincent University, in the Master of Arts Communication program.

Appendix 2—Informed Consent (also attached in the Qualtrics Survey)

Department of Communication Studies

Informed Consent

Ethics in Science Communication

Primary Investigator: Dayna Bell (Master of Arts Communication candidate)

Research Supervisor: Dr. Anthony Yue, Dept. of Communications, MSVU

Emails: [redacted]

Anthony.yue@msvu.ca

Phone: Dayna - [redacted]

Tony - (902) 457- 6244

What is the purpose of this study? You are invited to participate in a voluntary research study designed to explore the ethics of science communication. The purpose of the study is to grasp the basics of ethics in a field that is vastly unexplored.

What will I be asked to do? This study will be completed in one part during the summer of 2015, and should you decide to participate, you will be asked to complete this online questionnaire at your convenience. The questionnaire will ask a series of multiple choice questions and participating in this study will take approximately 45 minutes of your time. Please be advised that there is no wrong answer, and to answer the multiple choice questions as truthfully as possible.

Are there any risks involved? There are no significant risks associated with participating in this study. As mentioned above, participating involves an online questionnaire with multiple choice questions. Please keep in mind that participation in this study is voluntary, with no direct benefits other than conveying your own experiences via multiple choice answers. If, for any reason, you wish to quit and discontinue your participation, you are completely free to do so without consequence or penalty. You may also decline answering any question that you do not feel comfortable answering. All questionnaire responses given, and used in the future, will be stripped of all defining characteristics (such as name, and workplace) that would link responses to you personally.

Who will see my responses? With the exception of the researcher, and the researcher's supervisor, no one will have access to your responses. All of the data collected in this study will be stored electronically and be kept password protected. All information collected will be held with strict confidentiality; however, it is important to mention that I am obliged to report any information that violates the researcher's code of confidentiality (such as mention of abuse, threats, etc.) via the appropriate resources.

How will the information gathered be used?

All information gathered from questionnaire will be used as part of a thesis research study. Should you choose to discontinue your participation, your data will not be used in this study or any future research

endeavors. All of your data, if you withdraw, will be deleted in its entirety, including any of your data on USB sticks, and/or computers.

The information that is used, however, will be later presented a thesis defense in 2015.

Who can I speak to if I have questions or concerns about the study? The researcher welcomes any questions before, during, or after the study. To that end, she can be reached via email [redacted] or phone [redacted]. If you would like a copy of the results when the study is complete, please submit your email address at the end of the questionnaire via a separate link.

This study has been reviewed and approved by the Mount Saint Vincent University Review Ethics Board. If you have questions about how this study is being conducted and wish to speak with someone who is not directly involved in the study, you may contact the Chair of the University Research Ethics Board (UREB) c/o MSVU Research and International Office, at 457-6350 or via email at research@msvu.ca.

In clicking the next button, I am freely agreeing to the following statements above, including participating in this online questionnaire, and will participate in the research study, Ethics in Science Communication. I also agree to hold strict confidentiality regarding all parts of the study including all questions during the questionnaire process, and post completion.

Please print this page for your personal records and keep throughout the experiment.

Appendix 3—Email Survey (hyperlinked to last main questionnaire question via Fluid Surveys)

Thesis- Moral Reasoning Emails
Q1 Thank you for completing the questionnaire. If you would like more information after the study is complete, please leave your email in the box below.

Appendix 4- Qualtrics Survey: Demographics, Defining Issues Test, and Unified Theory of Acceptance and Use of Technology

Q3 To begin, please fill out the following demographics questions about yourself: What is your sex?

- ❍ Male (1)
- ❍ Female (2)
- ❍ Prefer not to answer (3)

Q4 What is your age (in years)?

Q5 How many years of work experience do you have within the discipline of science communication (in years)?

- ❍ 0-5 (1)
- ❍ 6-10 (2)
- ❍ 11-15 (3)
- ❍ 16-20 (4)
- ❍ 21+ (5)

Q9 What percentage of your time is spent communicating science, science-based information, and/or science findings?

_____ Percentage of Time (1)

Q6 Do you define yourself as a science communicator?

- ❍ Yes (1)
- ❍ No (2)

Q7 Do you have any prior ethical training?

- ❍ Yes (1)
- ❍ No (2)

Q8 If yes to the last question, what type of ethical training do you have? (Work related/University Course/ Personal/ Other)

- Work training (i.e.,professional development) (1)
- University course (2)
- Personal (i.e. spiritual) (3)
- Other, please specify (4) _____
- Not Applicable (5)

Q10 The following section of the questionnaire is aimed at understanding how people think about social problems. Different people often have different opinions about questions of right and wrong. There are no "right" answers in the way that there are right answers to math problems. We would like you to tell us what you think about several problem stories. In this section, you will be asked to give your opinions about several stories. Each story will include a two-part answer. You will first read the brief story and then begin Part A. For Part A, you will be asked to rank the importance of certain factors of the story you just read on a scale from "Great" to "No". In Part B you will be asked to choose the most important question from the list of questions from Part A, and then do likewise for the 2nd, 3rd and 4th most important choices. The following is an EXAMPLE Question:

Q11 Frank Jones has been thinking about buying a car. He is married, has two small children and earns an average income. The car he buys will be his family's only car. It will be used mostly to get to work and drive around town, but sometimes for vacation trips also. In trying to decide what car to buy, Frank Jones realized that there were a lot of questions to consider. If you were Frank Jones, how important would each of these questions be in deciding what car to buy?On the right hand side check one of the spaces by each statement of a consideration. (For instance, if you think that statement #1 is not important in making a decision about buying a car, check the space on the right).Part A:

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. Whether the car dealer was in the same block as where Frank lives. (Note that in this sample,	❍	❍	❍	❍	❍

the person taking the questionnaire did not think this was important in making a decision). (1)					
2. Would a used car be more economical in the long run than a new car. (Note that a check was put in the far left space to indicate the option that this is an important issue in making a decision about buying a car). (2)	❍	❍	❍	❍	❍
3. Whether the color was green Frank's favourite color. (3)	❍	❍	❍	❍	❍
4. Whether the	❍	❍	❍	❍	❍

cubic inch displacement was at least 200. (Note that if you are unsure about what "cubic inch displacement" means, then mark it no importance). (4)					
5. Would a large, roomy car be better that a compact car. (5)	❍	❍	❍	❍	❍
6. Whether the front connibilies were differential. (Note that if a statement sounds like gibberish nonsense to you, mark it "no importance"). (6)	❍	❍	❍	❍	❍

Q12 Part B: From the list of questions above, select the most important one of the whole group. Put the number of the most important question on the top line below. Do likewise for your 2nd, 3rd and 4th most important choices. Note that the top choices in this case will come from the statements that were checked on the far left-hand side--statements #2 and #5 were thought to be very important. In deciding what is the most important, a person would re-read #2 and #5, and then pick one of them as the most important, then put the other one as "second most important" and so on.

Most (1)

Second Most Important (2)

Third Most Important (3)

Fourth Most Important (4)

Q14 Heinz and the Drug In Europe a woman was near death from a special kind of cancer. There was one drug that the doctors thought might save her. It was a form of radium that a druggist in the same town had recently discovered. The drug was expensive to make, but the druggist was charging ten times what the drug cost to make. He paid $200 for the radium and charged $2000 for a small dose of the drug. The sick woman's husband, Heinz went to everyone he knew to borrow the money, but he could only get together about $1000, which is half of what it cost. He told the druggist that his wife was dying and asked him to sell it cheaper or let him pay later. But the druggist said, "No, I discovered the drug and I'm going to make money from it." So Heinz got desperate and began to think about breaking into the man's store to steal the drug for his wife. Should Heinz steal the drug? (Choose one)

- ❍ Should steal it (1)
- ❍ Can't decide (2)
- ❍ Should not steal it (3)

Q22 Importance:

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. Whether a community's laws are going to be upheld. (1)	❍	❍	❍	❍	❍
2. Isn't it only natural for a loving husband to care so much for his wife that he'd steal? (2)	❍	❍	❍	❍	❍

3. Is Heinz willing to risk getting shot as a burglar or going to jail for the chance that stealing the drug might help? (3)	❍	❍	❍	❍	❍
4. Whether Heinz is a professional wrestler, or has considerable influence with professional wrestlers. (4)	❍	❍	❍	❍	❍
5. Whether Heinz is stealing for himself or doing this solely to help someone else. (5)	❍	❍	❍	❍	❍
6. Whether the druggist's rights to his invention have to be respected. (6)	❍	❍	❍	❍	❍

7. Whether the essence of living is more encompassing than the termination of dying, socially and individually. (7)	❍	❍	❍	❍	❍
8.What values are going to be the basis for governing how people act towards each other. (8)	❍	❍	❍	❍	❍
9. Whether the druggist is going to be allowed to hide behind a worthless law in which only protects the rich anyhow. (9)	❍	❍	❍	❍	❍
10. Whether the law in this case is getting in the	❍	❍	❍	❍	❍

way of the most basic claim of any member of society. (10)					
11. Whether the druggist deserves to be robber for being so greedy and cruel. (11)	❍	❍	❍	❍	❍
12. Would stealing in such a case bring about more total good for the whole society or not. (12)	❍	❍	❍	❍	❍

Q15 From the list of questions above, select the four most important:

Most (1)

Second Most Important (2)

Third Most Important (3)

Fourth Most Important (4)

Q23 Student Take-Over: At Harvard University a group of students, called the students for a Democratic Society (SDS), believe that the University should not have an army ROTC program. SDS students are against the war in Viet Nam, and the army training program helps send men to fight in Viet Nam. The SDS students demanded that Harvard end the army ROTC training program as a university course. This would mean that Harvard students could not get army training as part of their regular course work and not get credit for it towards their degrees. Agreeing with the SDS students, the Harvard professors voted to end the ROTC program as a university course. But the President of the University stated that he wanted to keep the army program on campus as a course. The SDS students felt that the President was not going to pay attention to the faculty vote or to their demands. So, one day last April, two hundred SDS students walked into the university's administration building, and told everyone else to get out. They said they were doing this to force Harvard to get rid of the army training programs as a course. Should the students have taken over the administration building? (Choose one)

- ❍ Yes, they should take it over (1)
- ❍ Can't decide (2)
- ❍ No, they shouldn't take it over (3)

Q24 Importance:

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. Are the students doing this to really help other people or are they doing it just for kicks? (1)	❍	❍	❍	❍	❍
2. Do the students have any	❍	❍	❍	❍	❍

right to take over property that doesn't belong to them? (2)					
3. Do the students realize that they might be arrested and fined, and even expelled from school? (3)	❍	❍	❍	❍	❍
4. Would taking over the building in the long run benefit more people to a greater extent? (4)	❍	❍	❍	❍	❍
5. Whether the president stayed within the limits of his authority in ignoring the faculty vote. (5)	❍	❍	❍	❍	❍
6. Will the take over anger the public and give	❍	❍	❍	❍	❍

all students a bad name? (6)					
7. Is taking over a building consistent with principles of justice? (7)	❍	❍	❍	❍	❍
8.Would allowing one student take-over encourage many other student take-overs? (8)	❍	❍	❍	❍	❍
9. Did the president bring this misunderstanding on himself by being so unreasonable and uncooperative? (9)	❍	❍	❍	❍	❍
10. Whether running the university ought to be in the hands of a few	❍	❍	❍	❍	❍

administrators or in the hands of all the people. (10)					
11. Are the students following principles which they believe are above the law? (11)	❍	❍	❍	❍	❍
12. Whether or not university decisions ought to be respected by students. (12)	❍	❍	❍	❍	❍

Q25 From the list of questions above, select the four most important:

Most (1)

Second Most Important (2)

Third Most Important (3)

Fourth Most Important (4)

Q26 Escaped Prisoner A man had been sentenced to prison for 10 years. After one year, however, he escaped from the prison, moved to a new area of the country, and took on the name of Thompson. For 8 years he worked hard, and gradually he saved enough money to buy his own business. He was fair to his customers, gave his employees top wages, and gave most of his own profits to charity. Then one day, Mrs. Jones, an old neighbour, recognized him as the man who had escaped from prison 8 years before, and whom the police had been looking for. Should Mrs. Jones report Mr. Thompson to the police and have him sent back to prison? (Choose one)

- ❍ Should report him (1)
- ❍ Can't decide (2)
- ❍ No, they shouldn't take it over (3)

Q28 Importance:

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. Hasn't Mr. Thompson been good enough for such a long time to prove he isn't a bad person? (1)	❍	❍	❍	❍	❍
2. Every time someone escapes punishment for a crime, doesn't that just encourage more crime? (2)	❍	❍	❍	❍	❍

3. Wouldn't we be better off without prisons and the oppression of our legal systems? (3)	❍	❍	❍	❍	❍
4. Has Mr. Thompson really paid his debt to society? (4)	❍	❍	❍	❍	❍
5. Would society be failing what Mr. Thompson should fairly expect? (5)	❍	❍	❍	❍	❍
6. What benefits would prisons be apart from society, especially for a charitable man? (6)	❍	❍	❍	❍	❍
7. How could anyone be so cruel and heartless as to	❍	❍	❍	❍	❍

send Mr. Thompson to prison? (7)					
8.Would it be fair to all the prisoners who had to serve out their full sentences if Mr. Thompson was let off? (8)	❍	❍	❍	❍	❍
9. Was Mrs. Jones a good friend of Mr. Thompson? (9)	❍	❍	❍	❍	❍
10. Wouldn't it be a citizen's duty to report an escaped criminal, regardless of the circumstances? (10)	❍	❍	❍	❍	❍
11. How would the will of the people and the public good best	❍	❍	❍	❍	❍

be served? (11) 12. Would going to prison do any good for Mr. Thompson or protect anybody? (12)	❍	❍	❍	❍	❍

Q30 From the list of questions above, select the four most important:

Most (1)

Second Most Important (2)

Third Most Important (3)

Fourth Most Important (4)

Q31 The Doctor's Dilemma A lady was dying of cancer which could not be cured and she had only about six months to live. She was in terrible pain, but she was so weak that a good dose of pain-killer like morphine would make her die sooner. She was delirious and almost crazy with pain, and in her calm periods, she would ask the doctor to give her enough morphine to kill her. She said she couldn't stand the pain and that she was going to die in a few months anyway. What should the doctor do? (Choose one)

- ❍ He should give the lady an overdose that will make her die (1)
- ❍ Can't decide (2)
- ❍ Should not give the overdose (3)

Q32 Importance:

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. Whether the woman's family is in favor of giving her the overdose or not. (1)	❍	❍	❍	❍	❍
2. Is the doctor obligated by the same laws as everybody else if giving her an overdose would be the same as killing her. (2)	❍	❍	❍	❍	❍
3. Whether people would be	❍	❍	❍	❍	❍

much better off without society regimenting their lives and even their deaths. (3)					
4. Whether the doctor could make it appear like an accident. (4)	❍	❍	❍	❍	❍
5. Does the state have the right to force continued existence on those who don't want to live. (5)	❍	❍	❍	❍	❍
6. What is the value on death prior to society's perspective on personal values. (6)	❍	❍	❍	❍	❍
7. Whether the doctor has sympathy for the woman's	❍	❍	❍	❍	❍

suffering or cares more about what society might think. (7)					
8. Is helping to end another's life ever a responsible act of cooperation. (8)	❍	❍	❍	❍	❍
9. Whether only a person's religious beliefs should decide when a person's life should end. (9)	❍	❍	❍	❍	❍
10. What values the doctor has set for himself in his own personal code of behavior. (10)	❍	❍	❍	❍	❍
11. Can society afford to let everybody end	❍	❍	❍	❍	❍

their lives when they want to. (11)					
12. Can society allow suicides or mercy killing and still protect the lives of individuals who want to live. (12)	❍	❍	❍	❍	❍

Q33 From the list of questions above, select the four most important:

Most (1)

Second Most Important (2)

Third Most Important (3)

Fourth Most Important (4)

Q34 Webster: Mr. Webster was the owner and manager of a gas station. He wanted to hire another mechanic to help him, but good mechanics were hard to find. The only person he found who seemed to be a good mechanic was Mr. Lee, but he was of Asian decent. While Mr. Webster himself didn't have anything against Asian individuals, he was afraid to hire Mr. Lee because many of his customers didn't like Asians. His customers might take their business elsewhere if Mr. Lee was working in the gas station.When Mr. Lee asked Mr. Webster if he could have the job, Mr. Webster said that he had already hired someone else. But Mr. Webster really had not hired anybody, because he could not find anybody who was a good mechanic besides Mr. Lee. What should Mr. Webster have done? (Choose one)

- ❍ Should have hired Mr. Lee (1)
- ❍ Can't decide (2)
- ❍ Should not have hired him (3)

Q38 Importance:

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. Does the owner of a business have the right to make his own business decisions or not? (1)	❍	❍	❍	❍	❍
2. Whether there is a law that forbids racial discrimination in hiring for jobs. (2)	❍	❍	❍	❍	❍

3. Whether Mr. Webster is prejudiced against Asians himself or whether he means nothing personal in refusing the job. (3)	❍	❍	❍	❍	❍
4. Whether hiring a good mechanic or paying attention to his customers' wishes would be best for his business. (4)	❍	❍	❍	❍	❍
5. What individual differences ought to be relevant in deciding how society's roles are filled. (5)	❍	❍	❍	❍	❍
6. Whether the	❍	❍	❍	❍	❍

greedy and competitive capitalistic system ought to be completely abandoned. (6)					
7. Do a majority of people in Mr. Webster's society feel like his customers or are a majority against prejudice? (7)	❍	❍	❍	❍	❍
8. Whether hiring capable men like Mr. Lee would use talents that would otherwise be lost to society. (8)	❍	❍	❍	❍	❍
9. Would refusing the job to Mr. Lee be consistent with Mr. Webster's	❍	❍	❍	❍	❍

own moral beliefs? (9)					
10. Could Mr. Webster be so hard-hearted as to refuse the job, knowing how much it means to Mr. Lee? (10)	❍	❍	❍	❍	❍
11. Whether the religious beliefs to love your fellow man applies in this case. (11)	❍	❍	❍	❍	❍
12. If someone's in need, shouldn't he be helped regarding less of what you get back form him? (12)	❍	❍	❍	❍	❍

Q39 From the list of questions above, select the four most important:

Most (1)

Second Most Important (2)

Third Most Important (3)

Fourth Most Important (4)

Q40 Newspaper: Fred, a senior in high school, wanted to publish a newspaper for students so that he could express many of his opinions. He wanted to speak out against the war and to speak out against some of the school's rules, like the rule forbidding boys to wear long hair.When Fred started his newspaper, he asked his principal for permission. The principal said it would be all right if before every publication Fred would turn in all his articles for the principal's approval. Fred agreed and turned in several articles for approval. The principal approved all of them and Fred published two issues of the paper in the next two weeks.But the principal had not expected that Fred's newspaper would receive so much attention. Students were so excited by the paper that they began to organize protests against the hair regulation and other school rules. Angry parents objected to Fred's opinions. They phoned the principal telling him that the newspaper was unpatriotic and should not be published. As a result of the rising excitement, the principal ordered Fred to stop publishing. He gave as a reason that Fred's activities were disruptive to the operation of the school. Should the principal stop the newspaper? (Choose one)

- ❍ Should stop it (1)
- ❍ Can't decide (2)
- ❍ Should not stop it (3)

Q41 Importance:

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. Is the principal more responsible to students or to the parents? (1)	❍	❍	❍	❍	❍
2. Did the principal give his word that the	❍	❍	❍	❍	❍

newspaper could be published for a long time, or did he just promise to approve the newspaper one issue at a time? (2)					
3. Would the students start protesting even more if the principal stopped the newspaper? (3)	❍	❍	❍	❍	❍
4. When the welfare of the school is threatened, does the principal have the right to give orders to students? (4)	❍	❍	❍	❍	❍
5. Does the principal have the freedom of	❍	❍	❍	❍	❍

speech to say "no" in this case? (5)					
6. If the principal stopped the newspaper would he be preventing full discussion of important problems? (6)	❍	❍	❍	❍	❍
7. Whether the principal's order would make Fred lose faith in the principal. (7)	❍	❍	❍	❍	❍
8. Whether Fred was really loyal to his school and patriotic to his country. (8)	❍	❍	❍	❍	❍
9. What effect would stopping the paper have on the student's education in	❍	❍	❍	❍	❍

critical thinking and judgments? (9)					
10. Whether Fred was in any way violating the rights of others in publishing his own opinions. (10)	❍	❍	❍	❍	❍
11. Whether the principal should be influenced by some angry parents when it is the principal that knows best what is going on in the school. (11)	❍	❍	❍	❍	❍
12. Whether Fred was using the newspaper to stir up hatred and discontent. (12)	❍	❍	❍	❍	❍

Q43 From the list of questions above, select the four most important:

Most (1)

Second Most Important (2)

Third Most Important (3)

Fourth Most Important (4)

Q44 The following portion of the questionnaire will involve questions pertaining to the use of social media.Do you use social media for work-related purposes?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Occasionnally (3)

Q45 Please think about the social media tools that you use the most at work. Name up to THREE of these social media tools that you use in the spaces below.If you've answered "No" to the question above, please type in up to three social media tools your use on your personal time.

Social Media 1 (1)

Social Media 2 (2)

Social Media 3 (3)

Q46 Please keep in mind the three answers you've just given as your top three most used social media tools when answering the following questions.

_____ I find social media useful in my job (1)

_____ Using social media enables me to accomplish tasks more quickly (2)

_____ Using social media increases my productivity. (3)

_____ If I use social media, I will increase my chances of getting a raise. (4)

Q47 Please keep in mind the three answers given as your top three most used social media tools when answering the following questions.

_____ My interaction with social media is clear and understandable. (1)

_____ It is easy for me to get skillful at using social media. (2)

_____ I find social media easy to use. (3)

_____ Learning to operate social media is easy for me. (4)

Q48 Please keep in mind the three answers given as your top three most used social media tools when answering the following questions.

_____ Using social media is a good idea. (1)

_____ Using social media is a bad idea. (2)

_____ Social media makes work more interesting. (3)

_____ Working with social media is fun. (4)

_____ I like working with social media. (5)

Q49 Please keep in mind the three answers given as your top three most used social media tools when answering the following questions.

_____ People who influence my behaviour think that I should use social media. (1)

_____ People who are important to me think that I should use social media. (2)

_____ The senior management at work have been helpful in the use of social media. (3)

_____ In general, the organization has supported the use of social media. (4)

Q50 Please keep in mind the three answers given as your top three most used social media tools when answering the following questions.

_____ I have the resources necessary to us social media. (1)

_____ I have the knowledge necessary to use social media. (2)

_____ The main social media tool I use is not compatible with other social media tools I use. (3)

_____ A specific person (or group) is available for assistance with social media difficulties. (4)

Q51 Please keep in mind the three answers given as your top three most used social media tools when answering the following questions.I could complete task or job using social media...

_____ If there was no on around to tell me what to do as I go. (1)

_____ If I could call someone for help if I got stuck. (2)

_____ If I had a lot of time to complete the job for which the social media was provided. (3)

_____ If I had just the built-in help facility for assistance. (4)

Q52 Please keep in mind the three answers given as your top three most used social media tools when answering the following questions.

_____ I feel apprehensive about using social media. (1)

_____ It scares me to think that I could lose a lot of information using social media by hitting the wrong key. (2)

_____ I hesitate to use social media in fear of making mistakes that I cannot correct. (3)

_____ Social media is somewhat intimidating to me. (4)

Q53 Please keep in mind the three answers given as your top three most used social media tools when answering the following questions.

_____ I intend to use social media in the next... (1)

_____ I predict I would use social media in the next... (2)

_____ I plan to use social media in the next... (3)

Q54 The questionnaire is now complete. Thank you for your time and participation. If you would like more information on the study once it is complete, please follow the link below. Your email is required in a separate link to ensure that your questionnaire answers remain non-attributable to your email. https://qtrial2015az1.az1.qualtrics.com/SE/?SID=SV_eh5NQTBmkrNVjtr If you do not want to leave your email, please press the next button.

Appendix 5—Preliminary Research Study Questions from 2014

Preliminary Research Study Interview Questions*

- What do you consider ethics to be/being ethical to mean?
- Is there a strict code of ethics you follow that is enforced by your workplace?
- What types of ethical decisions do you have to make on a daily basis in your occupation?
- What do you consider an ethical dilemma to be?
- Have you ever encountered an ethical dilemma in the workplace?
- Do you find yourself using your own ethical beliefs/ideas/stances to make decisions in the workplace?
- Do you have any ethical training (courses etc.)?
- Do you think that science communication has its own ethics separate from other ethics?
- Social media- are their organization ethics involved?

***All questions (or a form of the question) were asked during the preliminary interview phase of the exploratory study (Autumn 2014). The particular order of the questions varied as the interview process was extremely organic in nature.*