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An Analysis of Communication Apprehension Between STEM and Non-STEM University Students

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An Analysis of Communication Apprehension Between STEM and Non-STEM University Students

by

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AN ANALYSIS OF COMMUNICATION APPREHENSION BETWEEN STEM AND NON-STEM UNIVERSITY STUDENTS

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Abstract

This study compares communication apprehension (CA) of undergraduate STEM and non-STEM students at a private university in the United States. Using a variation of the Personal Report of Communication Apprehension, undergraduate students were surveyed online and during in-person class sessions. Based on 409 ($N = 409$) survey responses, there was no significant difference in CA between STEM and non-STEM students. However, independent sample *t*-tests revealed differences in STEM for gender and year-level. Male students have significantly higher CA than their female classmates in all contexts. Additionally, senior students have significantly higher CA in group discussions and public speaking settings compared to freshmen students. This indicates that STEM and non-STEM students have little difference; however, when considering them individually, differences arise. Future research should be completed on the connection between CA and gender differences to understand why male students have higher CA.

Keywords: communication apprehension, STEM, interpersonal, public speaking

An Analysis of Communication Apprehension Between STEM and Non-STEM University Students

Communication apprehension (CA) is defined as an individual's level of fear with either real or associated communication (Richmond & McCroskey, 1985). This fear can sometimes hold individuals back when it comes to different types of communication, such as within a public speaking setting or in an interpersonal setting. It can also prevent the development of communication skills and how an individual communicates (Byrne, Flood, & Shanahan, 2012). This is because the individual will then avoid communication to limit the possibility of experiencing this fear (LittleJohn, Foss, & Oetzel, 2017).

Benchmark research indicates 10 to 20 percent of the population in the United States experiences extremely high levels of communication apprehension and another 20 percent experiences moderately high levels of communication apprehension (McCroskey, 1976). Another study also reported by McCroskey indicates at Michigan State University that 10 to 20 percent of college students sampled showed extremely high communication apprehension, while another 40 percent showed a sufficient degree of communication apprehension (McCroskey, 1972). It is easy to say with these statistics that communication apprehension is a problem many individuals face. Although estimates may vary from college to college, it is also easy to see that college students experience communication apprehension more often. College students choose to go into higher education because they wish to develop more in their field of choice before starting their careers. However, communication apprehension can affect the student's ability to obtain a professional position after college. Matsouka and Mihail (2016) indicate employers have experienced difficulties finding employees with specific skills. They indicate one of these sought-after skills is communication skills. Communication skills, or communication competence as communication

researchers call it, can be defined in many ways. Wiemann (1977) defines communication competence as how an individual chooses communication behaviors to be successful in their own interpersonal goals. Another definition explains communication competence as the ability to communicate effectively in society (Wiemann & Backlund, 1980). Whichever way it is defined, these definitions explain communication competence is an individual's ability to communicate effectively in a variety of ways and settings.

This study's purpose is to investigate the difference in CA among STEM and non-STEM university programs. STEM fields include, but are not limited to, engineering and computer science, and non-STEM fields include, but are not limited to, liberal arts and business. Arquero, Fernández-Polvillo, and Valladares-García (2017) explain students who lean toward a technical degree have higher CA. This could be for a number of reasons, but they indicate the reason students in a technical degree have higher CA is because they choose an educational path that is assumed to have less communication requirements (Arquero, Fernández-Polvillo, & Valladares-García, 2017). This in turn limits the communication opportunities they have to practice such skills. They could also be practicing avoidance as Rahman and Maarof's (2015) study shows. The study explains 46 percent of the engineering students surveyed expressed that they attempt to avoid communication situations, especially when meeting with peers.

My research study examines CA in STEM and non-STEM students to understand any differences in CA levels for these two sets of students. The study also examines how gender and academic year-level affect CA in STEM students. The results indicate that there was no statistically significant difference in CA between STEM and non-STEM undergraduate students. However, there were statistically significant findings regarding gender and academic year-level. These findings can help researchers by indicating where future research should be done, and by

adding information to the previous research completed on the population. The future research that should be done is an expansion of my study by collecting data from multiple universities on gender concerning CA.

Literature Review

Communication Apprehension

CA can be examined in trait, context, and state perspectives. Trait CA is an enduring form of apprehension an individual has over many varieties of communication situations (Daly, 1997). Trait is a form of personality trait that is highly resistant to change, but it can change if the proper measures are taken (McCroskey & Richmond, 1982). It is also based on fear or anxiety associated with many different types of communication (Daly, 1997).

Context CA is the second form. This form is an enduring personality type that leans toward communication in a given type of context (Richmond & McCroskey, 1985). This is usually the case when an individual is not fearful or anxious about many forms of communication but is fearful or anxious about one specific type of communication. Examples of specific types individuals are most fearful of are public speaking, job interviews, or meeting new people (Richmond & McCroskey, 1985).

State CA is the final form. Also known as situational CA, state CA is not a personality type that is strictly based on a response about the situation at hand (Richmond & McCroskey, 1985). Examples of this are also public speaking or interviews. The main attribute to remember is this form is not personality based and therefore it is not enduring; it only happens in the moment. One public speaking situation may cause state CA but the next time the same person is in a public speaking situation they could be confident and comfortable.

CA also has a variety of different views such as physiological, behavioral, and cognitive. Physiological views can be seen as a more physical reaction to anxiety such as blushing, increased heart rate, sweating, or shaking (LittleJohn et al., 2017). These reactions are very common and can describe not only CA but also speech anxiety as a whole.

Behavioral views consist of "manifestations such as avoidance and self-protection" (LittleJohn et al., 2017, p. 53). While this view may not be as apparent as the physiological view, it is the most disruptive. Richmond and McCroskey (1985) explain there are three common forms of behavioral responses: "communication avoidance, communication withdrawal, and communication disruption" (p. 60). Communication avoidance is simply when a person is fearful of something that leads them to avoid interacting with their fear. "[Those with CA] choose (either intentionally or unintentionally) to avoid communication with others whenever possible" (Richmond & McCroskey, 1985, p. 60). Not only do they avoid other people, but they also avoid situations where speaking is required. These situations could include class settings when speaking is mandatory. Communication withdrawal can be seen when individuals have no choice but to be in situations where communication is required. In these situations, the individual will limit their communication by "not answering questions" in class settings (Richmond & McCroskey, 1985, p. 61). These students only speak when spoken to and can be seen as unfriendly. Communication disruption is "when the person has disfluencies in verbal speech or unusual nonverbal behaviors" (Richmond & McCroskey, 1985, p. 61). These disruptions can come in the form of speech impediments like stuttering. While Richmond and McCroskey (1985) find this to be a common behavioral occurrence, they point out it could also be an indicator of poor communication skills in general, and therefore, may not be as good of a predictor of CA as the first two responses. The nature of these behaviors is to limit or altogether avoid the act of completing something.

Cognitive, the final view, focuses on negative thoughts and self-focus (LittleJohn et al., 2017). Each time an individual with CA must communicate, they are more prone to experience these negative thoughts about themselves. They also become hyperaware of what they say, what they do physically, and how their audience perceives them even if it is not the truth.

CA Among University Students (in STEM and non-STEM)

STEM is a common acronym for "science, technology, engineering and mathematics" (Lansiquot, 2016, p. 2). These fields have seen a rise in popularity over the last decade. Wright (2017) explains in the 2005-2006 academic year STEM programs in the United States had 350,000 graduates and this number increased to 550,000 graduates in the 2015-2016 academic year. This represents a 57% increase of STEM related graduates. As shown in Figure 1, at this rate I estimate the number of STEM graduates in 2020 will be 700,000. This is a notable 100% increase from the first year recorded.

Even though STEM has seen a steady increase, this does not diminish the needs for liberal arts and humanities-based degrees. Fanelli (2013) explains that liberal arts courses help build cultural intelligence. They help expand the students' knowledge of the world and prepare them for the working world. Students who do not take part in liberal arts courses "leave college as trainees [that] are not fully educated" (Fanelli, 2013, p. 35). This indicates students who do not engage in liberal arts courses do not graduate as well-rounded individuals who are knowledgeable in a variety of areas. Instead, they are only knowledgeable in their specific field of study, thus limiting their abilities.

However, students working towards STEM degrees seem to believe otherwise. Many students studying in STEM degrees do not believe that liberal arts or humanities courses are related to the major courses they are required to take (Lansiquot, 2016). This indicates that

students in STEM fields do not see the connection between their major of choice and the general education courses that supplement their STEM knowledge. This can have a large impact on the quality of these students' supplemental knowledge once they leave university. Adler (2016) explains liberal arts courses provide intellectual diversity and strengthen critical-thinking skills. Universities that provide liberal arts courses create more well-rounded students who carry their experiences onto their professional lives. The separation of major and non-major courses prevents the students to transfer skills between their general education courses and their major requirements (Lansiquot, 2016). These general education courses, especially the ones that teach communication, are necessary to every STEM major. A previous study completed by Hassall, Arquero, Joyce, Robinson, and Bramhall (2004) surveyed engineering, accounting, and business students using the Personal Report of CA-24 (PRCA-24). The study determined there was no significant difference between the accounting and business students. However, the total CA showed a significant difference between the engineering and business students. They specifically indicated the engineering students showed significantly higher written CA than the business students.

H1: Students studying in STEM fields will show higher CA than students studying in non-STEM fields.

CA of Male Versus Female Students in STEM

STEM is traditionally a very male dominated field, and due to this, women in STEM might feel like they are being exposed to a setting that is unwelcoming. Rudman and Phelan (2008) explain that women in male dominated fields can choose to either accept their gender stereotype and be viewed as incompetent, or go against the gender stereotype and potentially be looked at negatively by other women for acting manly. This conundrum could cause women to

feel like they should not speak up in this circumstance. A study completed by Shi, Brinthaupt, and McCree (2014) samples undergraduate students enrolled in a public speaking course. The results of this indicate female participates reported significantly higher levels of public speaking anxiety. This CA could be in direct relation with the fear of being judged by others in their field. Another study by Jaasma (1997) samples communication classes at two separate universities to test if there are any differences in classroom CA between male and female students. The results indicate that female students experience higher CA in the classroom than their male classmates.

H2: Female STEM students will show higher CA than male students.

CA by Academic Year

First year college students in any field have only high school level of experiences. This information is helpful while they are enrolled in high school, but once they leave this setting, their knowledge must increase to withstand the higher level of education they are experiencing. This is true for all forms of education, including communication. A study completed by Arquero et al. (2017) surveys high school students to question if their level of CA has an impact on their choices they made after high school. Of the group that planned to go to university, the individuals with the highest levels of CA indicate that they planned to study in technical fields. These fields include science, engineering, mechanics, and architecture. This is in comparison to those students who indicate their field of study being social or health science related. This shows that students who are coming into STEM fields from a high school setting have higher levels of CA than those going into non-STEM fields.

Another study completed by Rahman and Maarof (2015) samples first year engineering students in a communication course at a private university. The study concludes the CA of these students is considerably high. Of the students surveyed, 54 percent show a score of 80 on the

PRCA-24, which represents high CA. The results also indicate that many of the students surveyed disliked public speaking and felt nervous when engaging with new people in groups. This study shows even after these students leave the high school setting their CA still persists, but does not specify how long it lasts after.

H3: First-year STEM students will show higher CA than fourth- and fifth-year STEM students.

Method

I used the survey method to test my hypotheses. This method was selected because, as a researcher, surveys make data collection of a large population easier (Baxter & Babbie, 2003). This is because you can reach more people by doing a survey, especially if completing a self-administered survey. In my survey, I used the self-administered approach, and because of this, I was successfully able to recruit many individuals within my demographic.

I also chose the survey method because of the flexibility associated with the method. Baxter and Babbie (2003) indicate that because surveys tend to focus on one topic, it makes it easier to ask a number of questions on a specific topic, which gives you more flexibility when completing your analysis. For me, being able to ask additional questions made it so I could analyze the data in different ways to better understand the results.

The last positive to discuss is the questionnaire cannot, and will not, change based on the participant answers. This is important to note because in other methods the questions can change as the research is progressing. This gave me more ease when administering the survey because I did not have to worry about obtaining exact wording or probing the participants further (Baxter & Babbie, 2003). This gives the survey more structure and limits the possibility of the participants receiving different messages than other participants and thus responding differently.

Variables

My questionnaire was adapted from McCroskey's Personal Report of Communication Apprehension-24 (PRCA-24). McCroskey and Richmond (1982) explain that the PRCA-24 is a personality-type measure that predicts your CA based on your feelings about communication instead of a specific event or activity. I used a variation of the PRCA-24 because it is a well-researched tool that has had success in the past when measuring CA. I did decide to make some minor adjustments to PRCA-24 to make it more specific for my demographic. The variation I used focused on three of the four scales in the PRCA-24. The three scales selected were group discussion, interpersonal, and public speaking. These were selected to minimize the number of questions asked of participants and focus on specific situations that were important to my demographic. Cronbach's Alpha reliability test was conducted and it revealed the interpersonal scale ($\alpha = 0.88$), the group discussion scale ($\alpha = 0.89$), and the public speaking scale ($\alpha = 0.87$). Each had good reliability. The fourth scale for meetings was not used because in my demographic the participants do not frequent meetings. Any meetings they take part in tends to be in the form of group discussions or project teams.

In addition to the adaptation of the PRCA-24, my survey also asked questions such as college name, gender, age, academic year, and if the participant is enrolled in a communication minor or immersion. This information was collected after asking the PRCA-24 questions. This was done to assist those participating in focusing on the main questions by placing them first. The other questions asked, while also important, take less thought and can be easily answered second.

My survey used a multidimensional composite measure to allow a broader analysis of the necessary concepts. This concept is when the researcher uses several questions or components to measure a single variable (Baxter & Babbie, 2003). This measure allows me to ask several

questions pertaining to the same idea or concept that then creates a stronger indication of the results.

The survey questions that focused specifically on CA were put in the form of a Likert-type index. This 5-point continuum is often presented with the words strongly agree, agree, neither agree nor disagree or neutral, disagree, and strongly disagree (Baxter & Babbie, 2003). This format was ideal for my questionnaire because it helps to organize the questions in a coherent way where the participants can easily answer them. In some cases, the researcher will even choose to write some questions with positive words and others with negative words to reflect differing attitudes (Baxter & Babbie, 2003). For my questionnaire, I used both positive and negative words to understand further how the participant felt in the given situation. For some questions, I gave the participant two of the same questions: one using positive words and the other using negative words. The information obtained from these instances was later used when cleaning the data during analysis.

Sample

The individuals asked to complete this survey were undergraduate students from a private university who were studying in STEM and non-STEM fields. The STEM fields included, but were not limited to, engineering, engineering technology, science and math, computer and information sciences, and game design and development. The non-STEM fields included, but were not limited to, business administration, humanities, communication, and art. Graduate level students were not included in this study because it is assumed that students at this level have professional or work experience that lowers their CA.

Research Procedure

My study examined CA in STEM versus non-STEM fields. I recruited the students involved in the study by attending in-person class sessions and speaking with them directly after obtaining proper prior approval from the professors involved. Once in the class settings, I began by introducing myself and reading my informed consent to ensure that the participants were fully aware of the survey information before starting. I then asked participants to raise their hand if they voluntarily chose to participate. I gave each person with their hand raised a questionnaire to complete. The participants completed the questionnaire with the understanding that all responses were voluntary and that they could stop participating at any time. Any professors who did not wish to have me attend an in-person class were given a Qualtrics link to the questionnaire online to email to their classes.

Data Analysis

Once the data was collected, I input all responses - both paper and online - into an Excel spreadsheet. I collected a total of 446 responses: 421 in-person surveys and 25 online surveys. The next step was to clean the data collected. I did this by first removing 26 cases of incomplete data. Incomplete data was considered to be any response that did not have every answer completed.

Once these were removed, I continued to clean the data by evaluating its accuracy. I did this by comparing all data in the Likert scale responses that do not likely have the same answers. I compared the following statements:

"While participating in a conversation with a new acquaintance, I feel very nervous," and "While conversing with a new acquaintance, I feel very relaxed."

"I have no fear of speaking up in conversations," and "I'm afraid to speak up in conversations."

"Usually I am very tense and nervous in conversations," and "Usually I am very calm and relaxed in conversations."

"I dislike participating in group discussions," and "I like to get involved in group discussions."

"I am tense and nervous while participating in group discussions," and "I am calm and relaxed while participating in group discussions."

To complete this, I used conditional formatting in Excel and set rules that compared the responses for each of these statements. If the responses had the same answer for the two statements, the formatted rule changed the color of the cell containing that answer, indicating the consistency of the response. Once each of these rules was assigned and Excel finished evaluating the data, I manually went through the responses and double-checked the rules' accuracy. If any of the statements flagged under the rule had the answer "3" or "neutral," I removed the flag generated by the rule because these questions are assumed to be neither agree or disagree, meaning they could go either way. For the other responses, the data was deleted if they had more than one instance of the statements having the same answer excluding the answer "3." This deleted 11 responses.

Once the data cleaning was completed, I entered the data into IBM's SPSS software. I began by running the frequency distribution test on the demographic information (age, gender, academic year, and college department) and the communication minor or immersion question. As shown in Table 1, this test collected data on how many respondents selected specific answers within the demographic questions and converted the amount into a percentage out of 100.

After the demographic information was tested, I then moved on to the CA scales. Before I could use any of this data in my analysis, I first had to recode several questions. Recoding was

done to account for a mixture of negative and positive question types that were listed in my questionnaire. If the question was positive in nature, it was recoded to the complete opposite number on the Likert scale. One changed to five, two changed to four, and so on. The only number that remained the same in the recoding process was three because this number indicated a neutral/neither agree or disagree response. I then moved to creating scales for each of the CA scales. This was done to enable the ability to test for reliability of the data. Creating groups was completed by selecting each question from each of the scales (interpersonal, group discussions, and public speaking) and separating them into their own group. This created three separate groups I could now use to process and further understand the data.

I completed the reliability test next. I used the new scale groups I created and input them individually through the reliability analysis function. This created a Cronbach's Alpha reliability score for each group. I then moved to the independent sample *t*-tests. Before I could run this test, I first had to create groups for STEM and non-STEM and groups for freshmen and seniors, much like creating the groups for the CA scales. To create the STEM and non-STEM groups, I classified each college as either STEM or non-STEM and assigned them to the appropriate group. The same occurred for the year-level; if the student indicated they were a first-year student they were put in the freshmen group. If they indicated they were a fourth, fifth, or sixth plus year then they were combined into the senior group.

I was able to complete a number of independent sample *t*-tests. The completed independent sample *t*-tests include, but are not limed to: CA of STEM versus non-STEM students, CA of STEM and non-STEM students factoring their communication experience, CA of STEM and non-STEM students factoring in gender, CA of STEM and non-STEM students factoring their gender and communication experience, and CA of STEM and non-STEM students

factoring in their year-level. Most of these were used to answer my hypotheses; however, the two with the additional factor of communication experience were completed to further understand if certain factors impacted the CA levels of specific students.

Results

The sample size for my study was 409 ($N = 409$). As shown in Table 1, out of the 409 participants, 268 were male and 131 were female. The participants ranged from 18 years old or younger to 25 years old or older with a majority of participants at 18 years old or younger (103) and 19 years old (115). The participants also ranged in year-level in college and college department. For year-level, the majority of students were in their first year (171) followed by students in their second year (84). As for the college departments, the highest number of participants came from Golisano College of Computer and Information Science, or GCCIS, (136) followed by Saunders College of Business, or SCB (80). Out of all the participants, only 50 were enrolled in a communication minor or immersion.

My first hypothesis (H1) predicted that STEM students would have a higher level of CA than non-STEM students; this hypothesis was not supported. As shown in Table 2, three separate independent-sample *t*-tests were conducted. It was found that in interpersonal CA STEM students had a slightly higher level of CA ($M = 3.27$, $SD = 0.87$) than non-STEM students, however, the data was not significantly significant ($M = 3.25$, $SD = 0.81$), $t(407) = 0.17$, $p = 0.87$. STEM students were also found to have a slightly higher level of CA in group discussions ($M = 3.49$, $SD = 0.85$) than non-STEM students ($M = 3.48$, $SD = 0.90$), $t(407) = 0.14$, $p = 0.89$. These findings were also not statistically significant. Lastly, in public speaking situations, both STEM ($M = 2.81$, $SD = 0.94$) and non-STEM ($M = 2.81$, $SD = 0.91$) students had about the same level of CA, $t(407)$

= -0.46, $p = 0.65$. Overall, it was concluded that there are no statistically significant differences in CA levels between STEM and non-STEM.

My second hypothesis (H2) predicted that female STEM students would show higher levels of CA than male students; this hypothesis was not supported. An initial analysis was conducted to consider male data versus female data without the addition of STEM or non-STEM. As shown in Table 3, three separate independent-sample *t*-tests were conducted. For interpersonal CA, it was found that male students ($M = 3.37$, $SD = .85$) had a statistically significant difference than female students ($M = 3.08$, $SD = .80$), $t(397) = 3.31$, $p < 0.01$. For group discussion CA, it was found that male students ($M = 3.60$, $SD = .79$) had a statistically significant difference than female students ($M = 3.26$, $SD = .96$), $t(397) = 3.76$, $p < 0.001$. Lastly, for public speaking, it was found that male students ($M = 2.96$, $SD = .87$) had a statistically significant difference than female students ($M = 2.52$, $SD = .96$), $t(397) = 4.59$, $p < 0.001$.

I split the file data by STEM and non-STEM and separate independent sample *t*-tests were conducted. As shown in Table 3, three separate independent-sample *t*-tests were conducted for STEM. For interpersonal CA, it was found that male STEM students ($M = 3.36$, $SD = .87$) had a statistically significant difference than female STEM students ($M = 2.98$, $SD = .78$), $t(261) = 2.97$, $p < 0.01$. For group discussion CA, it was found that male STEM students ($M = 3.60$, $SD = .79$) had a statistically significant difference than female STEM students ($M = 3.13$, $SD = .92$), $t(407) = 3.85$, $p < 0.001$. Lastly, for public speaking, it was found that male STEM students ($M = 2.90$, $SD = .89$) had a statistically significant difference than female STEM students ($M = 2.42$, $SD = .99$), $t(407) = 3.62$, $p < 0.001$.

Also shown in Table 3, three separate independent-sample *t*-tests were conducted for non-STEM as well. For interpersonal CA, it was found that male non-STEM students ($M = 3.42$, $SD =$

.76) had a statistically significant difference than female non-STEM students (M = 3.16, SD = .82), t(133.92) = 1.94, $p < 0.05$. For group discussion CA, it was found that male non-STEM students (M = 3.62, SD = .79) showed no statistically significant difference from female non-STEM students (M = 3.37, SD = .98), t(131.93) = 1.60, $p = 0.11$. Lastly, for public speaking, it was found that male non-STEM students (M = 3.14, SD = .78) had a statistically significant difference than female non-STEM students (M = 2.61, SD = .93), t(132.95) = 3.61, $p < 0.001$.

My third hypothesis (H3) predicted that first year (freshman) STEM students would show higher CA than fourth-and fifth-year (senior) STEM students; this hypothesis was not supported. An initial analysis was conducted to consider freshman data versus senior data without the addition of STEM or non-STEM. As shown in Table 4, three separate independent-sample t-tests were conducted. For interpersonal CA, it was found that senior students (M = 3.39, SD = .87) had a slightly higher CA than freshmen students (M = 3.17, SD = .84), t(257) = -1.92, $p = 0.06$ but this finding was not statistically significant. For group discussion CA, it was found that senior students (M = 3.58, SD = .83) had a slightly higher CA than freshmen students (M = 3.37, SD = .89), t(257) = -1.86, $p = 0.06$, but this finding was not statistically significant. Lastly, for public speaking, it was found that senior students (M = 2.98, SD = .93) had a statistically significant difference in CA than freshmen students (M = 2.73, SD = .93), t(257) = -2.10, $p < 0.05$; the finding was the seniors had higher CA than freshman in general.

I split the file data by STEM and non-STEM and separate independent sample t-tests were conducted. As shown in Table 4, three separate independent-sample t-tests were conducted. As for interpersonal CA, it was found that there was no statistically significant difference between freshmen STEM students (M = 3.14, SD = .89) and senior STEM students (M = 3.42, SD = .93), t(161) = 1.94, $p < 0.05$. However, as for group discussion CA and public speaking CA, senior

level STEM students had a significantly higher level of CA than freshmen level STEM students. Senior STEM students had higher group discussion CA ($M = 3.65$, $SD = .82$) compared to freshmen STEM students ($M = 3.27$, $SD = .90$), $t(161) = 2.74$, $p < 0.01$. Senior STEM students had higher public speaking CA ($M = 3.01$, $SD = .95$) compared to freshmen STEM students ($M = 2.57$, $SD = .95$), $t(161) = 3.61$, $p < 0.01$.

Also shown in Table 4, three separate independent-sample *t*-tests were conducted for non-STEM as well. For interpersonal CA, it was found that non-STEM freshmen students had a slightly lower level of CA ($M = 3.23$, $SD = 0.77$) than non-STEM senior students ($M = 3.30$, $SD = 0.64$), $t(94) = -0.43$, $p = 0.67$, however this data was not statistically significant. Non-STEM freshmen students were also found to have a slightly higher level of CA in group discussions ($M = 3.50$, $SD = 0.85$) than non-STEM senior students ($M = 3.37$, $SD = 0.83$), $t(94) = 0.63$, $p = 0.53$; this data was also not statistically significant. In public speaking situations, non-STEM freshmen students were found to have slightly higher levels of CA ($M = 2.93$, $SD = 0.86$) than non-STEM senior level students ($M = 2.90$, $SD = 0.88$), $t(94) = 0.13$, $p = 0.90$; much like the data before it, this was also not statistically significant.

Discussion

This study considers CA between STEM and non-STEM undergraduate students at a private university. A variation of McCroskey's PRCA-24 was used to evaluate the student's CA levels where only three of the four scales were utilized. This study made this alteration because the demographic of the population would not frequently use the fourth scale of meetings. Richmond and McCroskey (1985) explain that CA is an individual's level of fear with either real or associated communication. This statement is accurate in some capacity of this study, however, none of the hypotheses were supported by the data collected.

The theoretical implication of my study is that it increases the general knowledge of CA while also considering current STEM and non-STEM undergraduate students. This will increase the general knowledge by providing more up-to-date information about CA that will then lead to further studies on the subject in this demographic. It also shows how the educational system is changing in regard to females in STEM. Gender in STEM is a topic that is currently popular, but not many also include the CA part behind this topic. This should be considered more with CA and further analyzed to obtain current data. The practical implications are that educators who are teaching STEM and non-STEM students should increase their communication activities available in their current class settings. The addition of new or revised communication activities should assist the students who were showing higher levels of CA in addressing and confronting their apprehension. STEM and non-STEM class settings that may not have as many presentations should add more group discussions or required interpersonal conversations with professors or teachers' assistants. STEM and non-STEM class settings that allow for more presentations should not only implement the additional group and interpersonal discussions, but also add in public speaking type options. The presentations do not need to be formal in nature; even having the students stand in front of the class and speak informally can help an individual's CA.

The first hypothesis predicted that STEM students would have higher CA than non-STEM students. My data found that there was no statistically significant difference between the CA of STEM and non-STEM undergraduate students. To further understand the data complied, I conducted another independent sample *t*-test on this information but split the data so that I received two results, one for freshman and one for senior STEM and non-STEM students. I did this because my sample size for freshmen was significantly higher than all the other data. It was assumed that because of this and because of the result of hypothesis three, the freshmen

respondents were drastically changing the overall result for this hypothesis. However, these results concluded that there was no significant difference between freshman and seniors in STEM and non-STEM, making this justification invalid.

Hassall et al. (2004) completed a study that analyzed the levels of CA of engineering, business, and accounting students. This study determines engineering students have significantly higher CA than the business students in their total CA sections, but when they dissect the information in detail between oral CA and written CA, it shows that engineering students have higher written CA and business students had higher oral CA in presentations. This shows a divide between the information on CA and explains how STEM and non-STEM students could end up with no difference. The justification is that each group is stronger in different forms of communication.

The second hypothesis predicted that female STEM students would have higher CA than male STEM students. This prediction was supported in numerous previous studies. Tannen (1991) explains that not only do female students feel more confident in a private setting versus a public setting, assuming that a classroom is public, but also, that male students are more comfortable speaking in group discussions and during class settings. Donovan and MacIntyre (2009) add that not only do female students at university show higher CA, but they also show lower self-perceived communication competence when comparing them to their male classmates. Lastly, Simons, Higgins, and Lowe (1995) conducted a study on business students that shows female accounting and management majors have higher CA around oral communication or public speaking than their male classmates. All these studies support my hypothesis by indicating that overall female students have higher CA in a variety of forms while also indicating female students have lower communication competence as well.

My analysis found the opposite of all these previous studies. At this private university, male STEM students have higher CA than female STEM students on each scale. This means male STEM students have a statistically significant difference in CA while participating in interpersonal communication, group discussions, and public speaking settings. In addition to the STEM results, the study also concluded that in non-STEM students male students also have higher CA than female students. The only difference between the STEM and non-STEM results is that males in non-STEM only have higher CA that is statistically significant in interpersonal communication and public speaking settings. Fischer, Schult, and Hell (2012) conducted a study on gender and performance in school; they conclude female students show more self-control and take more pride in their work. This explains why females have higher grades than male students. Although this study does not directly speak to CA, it could help explain why male students have higher CA in my study. A justification could be that female students take more pride in their work, and because of this, they are more confident with their work. Individuals less confident in their work may avoid communicating about their work. Another possibility is that, as previously stated, women in STEM feel they need to work harder in their field to gain respect from their counterparts. This could be the same with female STEM students. Female students in STEM could come into a college setting knowing that they must work harder to be respected in their field, and therefore, these settings only attract the students that are motivated to succeed. These theories could explain why males have higher CA than females.

The third hypothesis predicted that freshmen STEM students would have higher CA than senior STEM students. My prediction was supported in previous studies. Gardner, Milne, Stringer, and Whiting (2005) examine oral and written CA in accounting students and conclude

the level of CA did not increase as studies continued. This indicates that as instruction continues CA should not increase.

My study found the opposite of previous studies. At this private university, it was found that senior-level STEM students had a statistically significantly higher CA than freshmen-level STEM students on all scales. This means that senior STEM students have a higher CA and are more apprehensive while participating in interpersonal communication, group discussions, and public speaking settings compared to the freshmen STEM students. As for non-STEM students, not statistically significant data was found between freshmen and seniors. A justification of this result could be that senior students are recognizing that they are now coming to an end of their college experience, and therefore their adult lives are about to begin. One of the tasks a senior-level student must worry about is taking their new knowledge and their degree to find a position once they graduate. Abel, Deitz, and Su (2014) indicate in 2012, 44 percent of graduates were working a job that did not use their degree. They also indicate in 2010 the unemployment rate for recent college graduates was at 10 percent. With this information looming overhead, it is easy to see why a student who is graduating soon might feel higher levels of CA or even apprehension in general. It is also possible that STEM students experience less communication activities towards the end of their college experiences. It is possible that students have more classes that require communication early on in their academic career, and the further they progress in their field the less communication activities they have. This lack of association with these activities could result in little experience with communication. This ultimately would lead to students being more apprehensive. Another possibility could be freshmen students are coming from a precollege setting that has nurtured them before they came to college. This nurturing environment could have resulted in freshmen feeling more secure in their classroom environments. This comfortability

would change as the freshman increased year-levels. By the time they became seniors they are no longer accustom to a nurturing high school environment, and instead are more accustom to a less nurturing private college experience that is more intense in nature. This would cause CA because the students might be more fearful to communicate in non-nurturing environments.

Limitations

This study looked at CA of undergraduate STEM and non-STEM students at a specific university in the United States. Considering the research was completed at one university in the United States, a limitation was that the study disregarded any information that could have been collected from other universities. The research could have expanded to other universities that had either STEM or non-STEM students to deepen the respondent pool and to receive more variety in student type.

Another limitation was the number of female respondents. The university selected for research has a much larger male student body population; in fact, in 2019 the male population at this university was almost double the female population (About RIT, (n.d.)). In this study, the response rate for male students was much higher than female students, which, when considering the statistics from the university, could have also been solved if further research was completed at other universities.

Another limitation was that some respondents sped through the questionnaire to complete it quickly or did not complete it thoroughly. The number of responses would have been higher if I did not have to remove the amount of incomplete or inconsistent data I reviewed when cleaning due to these issues. After experiencing this in classes, I think a better way to have asked the students to participate would be to hand a survey out to each student before I explained my informed consent. After explaining this information, I then could have told the students to use the

questionnaire in front of them to participate, stressing that it was not mandatory. I would then set a ten-minute timer and collect all papers after this timer was up. This way, if a student did not wish to participate, they did not feel pressured to do so because everyone around them was having a survey handed to them. By following this procedure, I believe the number of rushed or incomplete surveys would have decreased.

The last limitation goes along with the prior limitation. As previously stated, I decided to go into classrooms to access my sample set quickly. This decision was effective; however, I could have just as easily converted my survey to only online. If I did this, I could have required that all of the questions be completed, which would have solved the incomplete questionnaire problem. It also would have taken away the possibility of students feeling embarrassed because they chose not to participate, or pressured to participate in general. Also, the online survey does not have a time limit so participants could take their time. In addition to it being helpful for the participants, it also would have helped me in a variety of ways. I would not have had to input the data manually, I would not have to attend in-person classes, and I could have reached a larger sample of my population.

Future Research

Future studies could take many different paths. The main study that should occur is further research on the gender differences in STEM and non-STEM individually. As my results indicated when one considered STEM and non-STEM, there is not much of a difference in CA. However, when one looks separately into gender in each category, it is easy to notice differences. This could be done by following the same quantitative approach as this study, completed by surveying students. However, one might also consider going a qualitative path instead and interviewing students. This not only would provide the answers to the initial questions, but will also allow for

probing to allow the researcher to ask follow-up and clarification questions. These follow-up and clarification questions would add an additional level to the study that a survey would struggle to obtain.

Another future study would be the expansion of my research. One could do this by contacting other universities that have STEM and non-STEM students in order to obtain a more diverse sample. By administering a questionnaire to other university students, the researcher would guarantee a more diverse sample that would come from an even wider variety of backgrounds. This study would also represent the population more accurately, instead of my study that only sampled one small section of the student community.

Taking the mixed method approach, another future study could take place that focuses first on the students and then on the professors. First, the researcher could survey the student to get an understanding of their CA. Once the survey data was completed, the researcher could then interview professors of the students surveyed to question the types of communication activities that are involved in their classes. This would add an extra element to the survey where the researcher would not only understand the CA of these students, but also what the professors do to combat the communication struggles these students have. The researcher could then offer suggestions of improvements to current practices and implementations of new practices proven to work for students.

Conclusion

This study examined the level of CA of STEM and non-STEM undergraduate college students at a private university in the United States. We found that there is no statistically significant difference between CA levels of STEM and non-STEM students. However, there was a difference when considering gender and year-level along with CA. It was found that male

STEM students have significantly higher CA overall compared to their female classmates, and male non-STEM students have significantly higher CA in interpersonal communication and public speaking settings compared to their female classmates. When looking at year-level it was found that senior STEM students have significantly higher CA than freshmen STEM students, and for non-STEM students there was no statistically significant difference in year-levels. There are many justifications for why these results concluded in this manner. However, the one certain element is further research needs to be completed on CA for gender and year-level, because previous studies have found the opposite of what my study has concluded.

CA is a fluid concept in communication research that will be ever changing, dependent on the population sampled. As the younger generations that have grown up with access to online communication become college students and adults, how will this change the thoughts behind CA currently? One thing that is bound to happen is that as younger generations become more dependent on online communication, their CA, or even their communication competence, will change. It is important for researchers who choose to study CA to acknowledge these changes and learn how to adapt to them. There is no way to tell at the moment where communication practices will lie in five or ten years, but it is easy to say that CA will be there along with any or all new forms of communication.

References

Abel, J. R., Deitz, R., & Su, Y. (2014). Are recent college graduates finding good jobs? *Economics and Finance*. *20*(1), 1–8. Retrieved from https://www.newyorkfed.org/research/current_issues

About RIT – By the Numbers. (n.d.) Retrieved from https://www.rit.edu/about-rit

Adler, I. (2016). No need to STEM liberal arts courses IPFW will best serve students through diversity of class offerings. *Journal – Gazette.* Retrieved from https://www.journalgazette.net/opinion/columns/No-need-to-STEM-liberal-arts-courses-13219927

Arquero, J. L., Fernández-Polvillo, C., & Valladares-García, D. (2017). Communication apprehension and students' educational choices. *Education & Training, 59*(9), 946–956. Retrieved from http://dx.doi.org/10.1108/ET-04-2017-0049

Baxter, L.A., & Babbie, E. (2003). *The basics of communication research*. Wadsworth, Cengage Learning.

Byrne, M., Flood, B., & Shanahan, D. (2012). A Qualitative Exploration of Oral Communication Apprehension. *Accounting Education*, *21*(6), 565–581. Retrieved from https://doi.org/10.1080/09639284.2012.725636

Daly, J. A. (1997). *Avoiding communication: Shyness, reticence, and communication apprehension*. Cresskill, N.J: Hampton Press.

Donovan, L. A., & MacIntyre, P. D. (2009). Age and sex differences in willingness to communicate, communication apprehension, and self-perceived competence. *Communication Research Reports*, *21*(4), 430–427. Retrieved from https://doi.org/10.1080/08824090409360006

Fanelli, S. A. (2013). A President's View on the Importance of the Liberal Arts in Community Colleges. *New Directions for Community Colleges*, *163*, 29–39. Retrieved from https://doi.org/10.1002/cc.20068

Fischer, F., Schult, J., & Hell, B. (2012). Sex differences in secondary school success: why female students perform better. *European Journal of Psychology of Education. 28*, 529–543. Retrieved from https://doi.org/10.1007/s10212-012-0127-4

Gardner, C. T., Milne, M. J., Stringer, C. P., & Whiting, R. H. (2005). Oral and written communication apprehension in accounting students: Curriculum impacts and impacts on academic performance. *Accounting Education*. *14*(3), 313–336. Retrieved from doi: 10.1080/06939280500077269

Hassall, T., Arquero, J., Joyce, J., Robinson, I., & Bramhall, M. (2004). Communication apprehension in U.K. engineering students: a comparative study. International Engineering Education I. 9.320.1-9.320.10. Retrieved from https://peer.asee.org/

Jaasma, M. A. (1997). Classroom Communication Apprehension: Does Being Male or Female Make a Difference? *Communication Reports*, *10*(2), 219–228. https://doi.org/10.1080/08934219709367677

Lansiquot, R. (2016). *Technology, Theory, and Practice in Interdisciplinary STEM Programs*. Brooklyn, New York: City University of New York, New York City College of Technology.

LittleJohn, S. T., Foss, K., & Oetzel, J. (2017). *Theories of Human Communication*. Long Grove, Illinois: Waveland, Press Inc.

Matsouka, K., & Mihail, D. M. (2016). Graduates' employability: What do graduates and employers think? *Industry and Higher Education*, *30*(5), 321–326. Retrieved from https://doi.org/10.1177/0950422216663719

McCroskey, J. C. (1976). The problems of communication apprehension in the classroom. *The Florida Speech Communication Journal*, *4*(2), 2. Retrieved from http://www.jamescmccroskey.com/publications/066.pdf

McCroskey, J. C. (1972). The Implementation of a Large-Scale Program of Systematic Desensitization for Communication Apprehension. *Speech Teacher*, *21*(4), 255. Retrieved from https://doi-org.ezproxy.rit.edu/10.1080/03634527209377961

McCroskey, J. C., & Richmond, V. P. (1982). *Communication apprehension and shyness: Conceptual and operational distinctions*. Central States Speech Journal. Retrieved from https://doi.org/10.1080/10510978209388452

Rahman, N. A., & Maarof, N. B. (2015). The effects of communicative activities in reducing engineering students' communication apprehension in Polytechnic. *Institute of Electrical and Electronics Engineers*. 87–93. Retrieved from 10.1109/ICMETC.2015.7449579

Richmond, V. P., & McCroskey, J. C. (1985). Communication: Apprehension, Avoidance, and Effectiveness. Scottsdale, Arizona: Gorsuch Scarisbrick, Publishers.

Rudman, L. A., & Phelan, J. E. (2008). Backlash effects for disconfirming gender stereotypes in organizations. *Research in Organizational Behavior*, *28*, 61–79. Retrieved from https://doi.org/10.1016/j.riob.2008.04.003

Shi, X., Brinthaupt, T. M., & McCree, M. (2014). The relationship of self-talk frequency to communication apprehension and public speaking anxiety. *Personality and Individual Differences*. *75*, 125–129. Retrieved from https://doi.org/10.1016/j.paid.2014.11.023

Simons, K., Higgins, M., & Lowe, D. (1995). A profile of communication apprehension in accounting majors: Implications for teaching and curriculum revision. *Journal of Accounting Education*. *13*(2), 159–176 Retrieved from https://doi.org/10.1016/0748-5751(95)00001-3

Tannen, D. (1991). Teachers' classroom strategies should recognize that men and women use language differently. *The Chronicle of Higher Education*, *37*(40), 2. Retrieved from https://ezproxy.rit.edu/login?url=https://search.proquest.com/docview/214661546?accountid=108

Wiemann, J. M. (1977). Explication and test of a model of communicative competence. *Human Communication Research*, 1977, *3*, 195–213. Retrieved from https://doi.org/10.1111/j.1468-2958.1977.tb00518.x

Wiemann, J. M., & Backlund, P. (1980). Current Theory and Research in Communicative Competence. *Review of Educational Research*, *50*(1), 185–199. https://doi.org/10.3102/00346543050001185

Wright, J. (2017). The Rise of STEM Majors and the Decline of Humanities Degrees. Retrieved from https://www.economicmodeling.com/2017/09/01/stem-majors-accelerating-every-state-just-humanities-degrees-declining/

Appendix A

Questionnaire

The following communication apprehension questions ask about behaviors associated with communicating in various formats**.** Please indicate which level applies to you by writing your answer in the space provided before the question.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	2	3	4	5

Please indicate how much you agree or disagree with the following statements. <u>Please consider a time when you spoke with a new acquaintance or professor.</u>

_____: While participating in a conversation with a new acquaintance, I feel very nervous.
_____: I have no fear of speaking up in conversations.
_____: Usually I am very tense and nervous in conversations.
_____: Usually I am very calm and relaxed in conversations.
_____: While conversing with a new acquaintance, I feel very relaxed.
_____: I'm afraid to speak up in conversations.

Please indicate how much you agree or disagree with the following statements. <u>Please consider a time when you spoke with a team or project group.</u>

_____: I dislike participating in group discussions.
_____: Generally, I am comfortable while participating in group discussions.
_____: I am tense and nervous while participating in group discussions.
_____: I like to get involved in group discussions.
_____: Engaging in a group discussion with new people makes me tense and nervous.
_____: I am calm and relaxed while participating in group discussions.

Please indicate how much you agree or disagree with the following statements. <u>Please consider a time when you spoke in front of a class (or gave a speech).</u>

_____: I have no fear of giving a speech.
_____: Certain parts of my body feel very tense and rigid while giving a speech.
_____: I feel relaxed while giving a speech.
_____: My thoughts become confused and jumbled when I am giving a speech.
_____: I face the prospect of giving a speech with confidence.
_____: While giving a speech, I get so nervous I forget facts I really know.

Are you currently enrolled in a Communication minor or immersion?

_____: Yes

_____: No

What is your year level in school?

_____: First Year Undergraduate

_____: Second Year Undergraduate

_____: Third Year Undergraduate

_____: Fourth Year Undergraduate

_____: Fifth Year Undergraduate

_____: Sixth Year Undergraduate or more

What college are you apart of (please check all that apply)?

_____: College of Art and Design (CAD)

_____: Saunders College of Business (SCB)

_____: School of Individualized Study (SOIS)

_____: Kate Gleason College of Engineering (KGCOE)

_____: College of Engineering Technology (CET)

_____: Golisano Institute for Sustainability (GIS)

_____: College of Liberal Arts (COLA)

_____: College of Science (COS)

_____: College of Heath Science and Technology (CHST)

_____: Golisano College of Computing and Information Science (GCCIS)

_____: National Technical Institute of the Deaf (NTID)

How old are you? _____

What gender do you identify with?

_____: Male

_____: Female

_____: Other

_____: Prefer not to say

Appendix B: Tables

Table 1

Sample Characteristics (N = 409)

Characteristic	*n*	%
Age (*N* = 409)		
18 and younger	103	25.0
19	115	28.1
20	75	18.3
21	43	10.5
22	48	11.7
23	12	2.9
24	4	1.0
25 and older	9	2.2
Gender (*N* = 409)		
Male	268	65.5
Female	131	32.0
Other	6	1.5
Prefer not to say	4	1.0
Year-Level (*N* = 409)		
First year	171	41.8
Second year	84	20.5
Third year	66	16.1
Fourth year	55	13.4
Fifth year	33	8.1
Sixth year and higher	0	0.0
College (*N* = 409)		
College of Art and Design (CAD)	34	8.3
College of Engineering Technology (CET)	63	15.4
College of Health Science and Technology (CHST)	16	3.9
College of Liberal Arts (COLA)	24	5.9
College of Science (COS)	20	4.9
Golisano College of Computing and Information Science (GCCIS)	136	33.3
Golisano Institute for Sustainability (GIS)	5	1.2
Kate Gleason College of Engineering (KGCOE)	27	6.6
Saunders College of Business (SCB)	80	19.6
School of Individualized Study (SOIS)	4	1.0
National Technical Institute for the Deaf NTID)	0	0.0
Communication Minor or Immersion (*N* = 409)		
Not enrolled in communication minor or immersion	359	87.8
Enrolled in communication minor or immersion	50	12.2

Table 2

CA in STEM Versus Non-STEM Students (N = 409)

	STEM Students			Non-STEM Students				
Variable	*n*	*M*	*SD*	*n*	*M*	*SD*	*t*	*p*
Interpersonal CA	267	3.27	.87	142	3.25	.81	0.17	.87
Group Discussion CA	267	3.49	.85	142	3.48	.90	0.14	.89
Public Speaking CA	267	2.81	.94	142	2.81	.91	-0.46	.65

Table 3

CA Between Genders: Overall (N = 409), in STEM Students, and in Non-STEM Students

	Male Students			Female Students				
Variable	*n*	*M*	*SD*	*n*	*M*	*SD*	*t*	*p*
CA by gender in students								
Interpersonal	268	3.37	.85	131	3.08	.80	3.31	.001
Group Discussion	268	3.60	.79	131	3.26	.96	3.76	.001
Public Speaking	268	2.96	.87	131	2.52	.96	4.59	.001
CA in STEM students								
Interpersonal	203	3.36	.87	60	2.98	.78	2.97	.01
Group Discussion	203	3.60	.79	60	3.13	.92	3.85	.001
Public Speaking	203	2.90	.89	60	2.42	.99	3.62	.001
CA in non-STEM students								
Interpersonal	65	3.42	.76	71	3.16	.82	1.94	.05
Group Discussion	65	3.62	.79	71	3.37	.98	1.60	.11
Public Speaking	65	3.14	.78	71	2.61	.93	3.61	.001

Table 4

CA Between Year-Levels: Overall (N = 409), in STEM Students, and in Non-STEM Students

Variable	Freshmen Students			Senior Students			*t*	*p*
	n	*M*	*SD*	*n*	*M*	*SD*		
CA between year-levels								
Interpersonal	171	3.17	.84	88	3.39	.87	-1.92	.06
Group Discussion	171	3.37	.89	88	3.58	.83	-1.86	.06
Public Speaking	171	2.73	.93	88	2.98	.93	-2.10	.05
CA between year-levels in STEM students								
Interpersonal	97	3.14	.89	66	3.42	.93	1.94	.05
Group Discussion	97	3.27	.90	66	3.65	.82	2.74	.01
Public Speaking	97	2.57	.95	66	3.01	.95	3.61	.01
CA between year-levels in non-STEM students								
Interpersonal	74	3.23	.77	22	3.30	.64	-.43	.67
Group Discussion	74	3.50	.85	22	3.37	.83	.63	.53
Public Speaking	74	2.93	.86	22	2.90	.88	.13	.90

Appendix C

Figures