ABSTRACT

EGAN WARREN, SARAH ELIZABETH. Professional Science Master’s Students’ Confidence and Competence with Presentation Skills (Under the direction of Dr. Michelle Bartlett).

The purpose of this study was to examine professional science master’s (PSM) degree students’ self-rated confidence with presentation skills and three instructors’ ratings of the students’ presentation competence. Using the Dunning-Kruger Effect (DKE) as the theoretical framework and inspired by the methodology of the scholarship of teaching and learning (SoTL), this study looked at four points of measurement of students’ self-rated confidence and compared the students’ ratings to instructors’ ratings of competence.

Five research questions guided this study. Question one described students’ self-reported confidence ratings. Question two described the three instructor’s ratings of students’ competence. Question three compared the students’ ratings with the instructors’ ratings. Question four examined if there was a statistically significant relationship between the students’ ratings and the instructors’ ratings. Question five determined if sex and age significantly influenced students’ self-assessed presentation confidence ratings.

The methodology for this study was a longitudinal, non-experimental quantitative research design using a single-question reflection assignment as the questionnaire. Participants were approximately 230 PSM students in a PSM program. The sampling method used was census. All the responses for the study came from ungraded reflective exercises (not tests or graded assignments) from students in the class of 2019 and the class of 2020.

The data was analyzed using Excel and R. Median, mode, and percents were used to analyze the data for research questions one and two. Question three was analyzed with percents.
Spearman’s correlation was used for research question four. Regression was used for research question five.

Three key findings of the study are: (1) this study affirms the work of Kruger and Dunning (1999) and shows evidence for the Dunning-Kruger Effect, (2) instructors’ ratings have only a moderate correlation with students’ confidence ratings, and (3) sex and age did not significantly influence students’ self-reported confidence scores. Two sets of recommendations, one for the researcher and one for PSMs, based on the findings are presented. In brief summary, those recommendations are that the researcher should continue to refine the research into confidence and competence, expand instruction on self-assessment, use the updated want/need presentation matrix, and use the dashboard to continue the critical examination of her teaching. PSMs should provide opportunities for self-assessment instruction, examine rating and feedback practices, consider using the want/need matrix and the dashboard, and establish best practices for feedback in communication courses.
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Professional Science Master’s Students’ Confidence and Competence with Presentation Skills

by
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DEDICATION

To Andrew M. Warren, and our children, Eleanor Grace and Jonah Peter, sine qua non.
BIOGRAPHY

Sarah Egan Warren has spent her career working with undergraduate and graduate students, faculty, and staff at four universities. She holds a BA in English from James Madison University and MS in Technical Communication from NC State University.

Sarah started her career in higher education in residence life at James Madison University. She credits her interest and desire to work with college students to her overwhelmingly positive experience at the Office of Residence Life as a resident advisor, administrative assistant, and hall director. After a short stint with Housing and Residence Life at UNC-Wilmington as a Residence Coordinator, she worked for University Housing at NC State University as a Residence Director.

Because she enjoyed her time living on college campuses and working with students to help them develop and thrive in their campus communities, even after Sarah made the move off-campus, she continued working for different departments at NC State including Registration and Records, the Registrar’s Office, Orientation, The Graduate School, Study Abroad Office, Industrial Engineering, the English department (as a Graduate Teaching Assistant, Lecturer, Senior Lecturer, and Assistant Director of the Professional Writing Program), and the Institute for Advanced Analytics. While working for the English Department, she created and delivered NC State’s first online offering of professional communication courses and then taught other faculty to teach online. Building off this experience, she also developed and taught a hybrid professional communication course for William Peace University. Outside of the classroom, she revitalized a defunct student organization in order to support students and create a sense of community for the technical communication professional science master’s degree program. That student organization went on to win numerous awards.
In 2010, she was awarded a study abroad grant to develop a new study abroad program aimed at encouraging engineering students to participate in study abroad. She created a faculty-led summer study abroad program in London that incorporated a rigorous writing and speaking curriculum while using London as part of the classroom. Students toured companies, factories, and job sites where they interviewed London engineers about communication in the workplace. After two iterations, Sarah expanded her study abroad program by adding an additional instructor and course. Creating and leading the study abroad program is one of Sarah’s personal and professional highlights.

Outside of her university experiences, Sarah has consulted for numerous companies on best practices for professional and technical communication, presentations, and online teaching. She also delivers presentations, workshops, and seminars. At the time of this dissertation, Sarah is the Head of Technical Communication for a professional science master’s degree program in analytics. There, she developed the writing and speaking curriculum and teaches professional and technical communication classes.

At her core, Sarah is a life-long learner and educator. She was inspired to returned to school to expand her understanding of her own teaching and develop research skills that will allow her to more efficiently analyze her students’ work and her own teaching methods.
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I am thankful for my friends and family for cheering me on the whole way and understanding when I had to study. Your encouragement has meant so much.

Thanks to Shaun Bennet, NC State Research Librarian, for uncovering more information about the origin of the Dunning-Kruger Effect graphics.

Thanks to each of my parents for teaching me very different lessons about learning. I credit my mother, Sheilah Egan, for instilling in me a love of reading and the conviction that the answers can be found if you just keep reading. I certainly put those reading skills to work over the last four years of study and research. And I credit my father, Edward Egan, for showing me that it is never too late to expand your education or try something new.
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CHAPTER 1: INTRODUCTION & BACKGROUND

“Over the long term, demand for graduate scientists and engineers in business and industry is increasing; more employment options are available to graduate scientists and engineers who have multiple disciplines, minor degrees, personal communication skills, and entrepreneurial initiative” (Griffiths, 1995, p. 36).

Introduction

Communication, including the ability to deliver a presentation, is one of the top soft skills desired by employers (Bolivar-Cruz & Verano-Tacoronte, 2018; Curran, 2010; Kyllonen, 2013; Robles, 2012; Williams, 2017) because possessing technical ability alone is not sufficient for employees to succeed in the 21st-century workplace (Koenig, 2011; Petrone, 2019; Phillips & Phillips, 2015; Rao, 2012; Supiano, 2019). Of course, employers want bright and knowledgeable employees; however, a high GPA is not an automatic hire if soft skills are lacking (Jones, Baldi, Phillips, & Waikar, 2016). The demand for soft skills can be problematic for technically-minded graduate students lacking these skills because researchers have found that soft skills, and communication skills in particular, are challenging to teach and difficult for students to master (Daly, McCroskey, Ayres, Hopf, & Ayres, 1997; Hugenberg & Yoder, 1994; Magin & Helmore, 2001; Smith & Sodano, 2011). The need for both hard and soft skills created the concept of the T-shaped professional (Harris, 2009). The first use of the term “T-shaped” has been attributed to David Guest, and is defined as a professional who can “combine the benefits of deep problem-solving skills in one area, with broad complex-communication skills across many areas” (Donofrio, Spohrer, & Zadeh, 2010). The depth and breadth aspects can be visualized on a capital letter T. In the case of a data professional, the vertical line of the T symbolizes the depth of hard skills like programming, statistics, and math; the top of the letter T symbolizes the breadth of soft skills like
communication, teamwork, and leadership. The T-shaped professional stands in contrast to an I-shaped professional, someone who has only deep knowledge in one area. Of course, developing depth and breadth takes time and effort (Donofrio, Sanchez, & Spohrer, 2010). But the effort is worth it as more workplaces are “adopting T-shaped hiring concepts” (Cotter, 2015, p. 12). The T-shaped professional is valuable because he/she can apply skills in many situations (Barile, Franco, Nota, & Saviano, 2012). However, T-shaped professionals do not just materialize, they must be developed. “Helping professionals develop interpersonal skills will serve them throughout their career” (Bierema, 2016, p. 63) and will benefit both the professional and industry.

Industry demand for soft skills like communication is influencing graduate education (Gorman & Klimberg, 2014; Griffiths, 1995; Marcel, 2015; Tobias & Strausbaugh, 2018). Specifically, professional science master’s (PSM) programs “were created in the late 1990s in response to STEM [Science, Technology, Engineering, and Math] workforce demands” (Harkins & Strausbaugh, 2017). With funding from the Alfred P. Sloan Foundation (Allum, 2013) and The William M. Keck Foundation (Lynch, 2011), PSMs were designed to be an alternative to a PhD and “combine solid advanced science / mathematics, a working knowledge of business principles, experience working in interdisciplinary groups and high-level communication and technical skills, capped by internships” (Tobias & Sims, 2006, p. 263). PSM programs refer to courses that teach soft skills as PLUS courses (Cassuto, 2015). PSM “PLUS courses [are] designed primarily to provide STEM graduates with job-related skills to prepare them for supervisory or management positions” (King, 2012, p. 24). These PLUS courses include courses on communication as well as ethics, leadership, management, teamwork and many other specialized topics (Colwell, 2009; Gitig, 2010).
Graduates from STEM PSM programs are expected to be able to communicate technical concepts and results to a wide variety of audiences (Lee, Long, & Visinescu, 2016; Sageev & Romanowski, 2001; Zhang, 2012). In particular, data analytics professionals must possess excellent presentation skills in order to communicate their analyses (Dubey & Gunasekaran, 2015). A data analyst must operate in the technical world of statistics, programming, and analytics and play a dual role in the world of strategy and business. Data analysts work in marketing, medicine, banking, retail, sports, insurance, and many other fields. No matter the business or industry, presentation skills are needed to succeed as a data analyst (Arora, 2017; Marcel, 2015).

Statement of the Problem

Employers and academics understand the importance of developing communication proficiencies such as presentation skills (Bass, 2010; Charoensap-Kelly, Broussard, Lindsly, & Troy, 2016; Donoho, 2017; Gibb, 2013; Kerby & Romine, 2009; Norback, 2013; Ulinski & O’Callaghan, 2002; van Ginkel, Gulikers, Biemans, & Mulder, 2015). Some students avoid communication, and presentations in particular (Nash, Crimmins, & Oprescu, 2016), because they may not recognize the ultimate importance of communication skills (Pittenger, Miller, & Mott, 2004); others may lack confidence in their presentation skills (Elfering & Grebner, 2011); and still others may suffer from communication anxiety (CA) (Daly et al., 1997; Jackson, Compton, Thornton, & Dimmock, 2017; McCroskey, 1977), public speaking apprehension (PSA) (Bodie, 2010; Miller & Stone, 2009), or public speaking anxiety (Behnke & Sawyer, 2001; Bippus & Daly, 1999; Nash et al., 2016; Witt & Behnke, 2006). Whatever the cause, students may be missing opportunities to develop the presentation skills necessary for the workplace, which can have a negative impact (McCroskey, 1977).
Even when students do engage in developing their communication skills, research has found that students’ self-reported level of confidence with their presentation skills do not always match their instructor-assessed competence (De Grez, Valcke, & Roozen, 2012; LeFebvre, LeFebvre, Blackburn, & Boyd, 2015; Smith & Sodano, 2011; Suñol et al., 2016). This is not a phenomenon unique to developing presentation skills. The same confidence / competence mismatch is observed in other fields, notably the medical field (Davis et al., 2006; Dehmer et al., 2013; Hodges, Regehr, & Martin, 2001; Shah, Haisch, & Noland, 2018).

The mismatch of confidence and competence can make it difficult for students to develop and improve the presentation skills that are needed for their future careers. If students are overconfident, they can miss the chance to improve poor skills and may make poor decisions (Callender, Franco-Watkins, & Roberts, 2016; Dunlosky & Rawson, 2012; Finn & Tauber, 2015). Students who underestimate themselves could be at risk for imposter phenomenon (Clance & Imes, 1978). Either overestimation or underestimation provides an opportunity for improvement because accurate self-assessment plays an important role in learning (Karnilowicz, 2012). Knowing strengths and weaknesses in a certain domain can be beneficial to improving them (Dunning, 2005).

**Purpose of the Study**

The purpose of this research is to examine how PSM analytics students’ self-reported confidence with their presentation skills relates to instructor-assessed competence of students’ presentation skills. The researcher seeks to analyze the students’ confidence ratings and instructors’ competence ratings to determine if a pattern of overestimation or underestimation occurs in this study population. It is important to note that the instructors’ competence ratings are
not related to the students’ grades. In order to examine PSM degree students’ confidence and competence with communication skills, the following research questions were created.

**Research Questions**

The questions that drove this study are:

- **Research Question 1:** What are the students’ self-reported confidence ratings as measured four times within five months of their presentation skills?
- **Research Question 2:** What are the instructors’ competence ratings of students’ presentation skills?
- **Research Question 3:** How do students’ self-reported confidence ratings as measured four times within five months compare (equal to, overestimated, or underestimated) to instructors’ competence ratings?
- **Research Question 4:** Is there a statistically significant relationship between students’ self-reported confidence with presentation skills and instructors’ rating of their presentation competence?
- **Research Question 5:** Do sex and age significantly influence students’ self-assessed presentation confidence ratings?

**Research Methodology**

Using a quantitative research design, this study analyzed data from ungraded student reflection responses and instructors’ assessment ratings. The instruments used to collect the student confidence ratings on a scale of one to five were the Initial Communication Assessment completed online before starting the PSM program and the communication check-in form used as a reflective exercise at the start of all communication classes. The instrument used to collect the competence ratings was a feedback sheet used by three instructors (including the researcher).
during the intensive four-day Communication Training Workshop (CTW). The purpose of the CTW is to improve students’ confidence with presentation skills and offer opportunities for practice in order to improve competence with presentation skills. During the CTW, the three instructors rated students on four presentations (introduction, impromptu, 5-minute data visualization, and team). After the CTW finished, the three instructors reviewed the ratings from the four presentations and assigned an overall competence rating. In addition, demographic information about sex and age was collected from the enrolled student database. Data was collected from approximately 230 PSM graduate students from the classes of 2019 and 2020. Excel, Google Sheets, and the open source programming language, R, were used to analyze the data. Descriptive statistics, correlations, and regression were used to analyze the data according to the five research questions.

**Theoretical Framework**

The theoretical framework for the study was based on the Dunning-Kruger Effect (DKE). DKE provides a framework to consider presentation skill confidence and competence in PSM graduate students. DKE has been cited in numerous studies (according to Google Scholar, over five thousand citations) to discuss the possible reasons for the mismatch between confidence and competence ratings. In short, Kruger and Dunning (1999) found that those incompetent in a skill were more likely to overestimate their ability because of a lack of metacognition. Those who were highly skilled tended to underestimate their expertise. Figure 1.1 shows a composite of the four visuals from Kruger and Dunning’s (1999) work.
Figure 1.1: Kruger & Dunning’s visuals from 1999 study.

The main take away is that those in the bottom quartile overestimate their performance while those in the top quartile underestimate their performance.

DKE was chosen for this study because of the alignment with the researcher’s interests about the potential role that confidence may play in developing competent communication skills. The DKE studies used participants’ predicted scores and compared them to their graded outcomes. For this study, students are not asked to predict their scores, but rather to provide a rating for their confidence in their presentation skills. The confidence rating replaced the predicted scores used in the DKE studies. In a similar manner to the DKE studies, PSM students’
confidence ratings of their presentation skills were compared to instructors’ competence ratings of the students’ presentations.

DKE has been used in many studies in diverse fields on topics such as alternative medicine, conspiracy theories, and media literacy (Plencner, 2014), high school standardized tests (Mattern, Burrus, & Shaw, 2010), wine tasting (Aquveque, 2018), the vaccine debate (Benegal, 2018; Motta, Callaghan, & Sylvester, 2018), politics (Anson, 2018), literacy skills (Khalid, 2016), the peer review process (Huang, 2013), social justice (West & Eaton, 2019), bridge players (Simons, 2013), astronomy (Hester, 2017), undergraduate science majors (Karatjas & Webb, 2017a), workplace concerns (Gibbs, Moore, Steel, & McKinnon, 2017), and medical competency studies (Hodges et al., 2001). Although DKE has found support from many researchers, like all theories, DKE does have its critics. Despite concerns (that will be addressed in chapter two), the DKE, used as the theoretical framework for this study, has value in examining the confidence and competence of analytics PSM students in regard to their presentation skills.

**Conceptual Framework**

The conceptual framework for the study included the five research questions driving the study and the variables used for the study. Data for the study comes from a question about confidence on the students’ initial communication assessment, their self-assessed confidence ratings from class exercises (at the start of the program, and at the beginning and at the end of the Communication Training Workshop), and instructor rating of students’ competence. Demographic data about sex and age comes from the enrolled student database. Figure 1.2 illustrates the conceptual framework for the study.
Figure 1.2: Conceptual framework for the study.

The first research question sought to determine students’ self-reported confidence levels at four different times: prior to starting their graduate studies, at the start of their graduate program, at the start of the CTW, and at the conclusion of the CTW. Similarly, the second research question examined the three instructors’ ratings of students’ competence for presentations based on observing the students’ four presentations during the CTW.

The third research question delved deeper into the findings of the first two research questions. After establishing the students’ confidence ratings and the instructors’ competence ratings, the focus of the third research question was to determine how the ratings compare using percentages to determine how many students rate themselves the same as the instructors’ ratings, how many students overestimate, and how many students underestimate.

The fourth research question sought to determine if there is a statistically significant relationship between how students rate their confidence with presentations and how instructors rate students’ competence with presentations.

The fifth research question examined how much the variance in students’ self-assessed confidence ratings is explained by the variables of sex and age. This is of special interest because
the original Kruger and Dunning (1999) study found that “gender failed to qualify any results” (p. 1123).

**Setting**

The setting for the study was a large research university in the South that is home to a PSM analytics program. Students complete their technical and PLUS courses in a consolidated full-time, cohort-based, residential master’s degree program. Communication skills are taught throughout the program including the four-day CTW.

**Significance of the Study**

This study will add to the growing body of knowledge about PSMs and the field of analytics. PSM degree programs are relatively new (1990s) and deserve more attention and research as the degree program matures and universities and employers adjust (Cassuto, 2015). The study of an analytics PSM is even more significant because of the growing and changing field of analytics. The field of analytics is only a few decades old (Davenport & Patil, 2012) and the first master’s program in analytics was started in 2007 (Fitzgerald, 2015). Many opportunities for research exist at this moment for PSMs and analytics. The different approaches of integrating the PLUS courses (Harkins & Strausbaugh, 2017) and interest in analytics made it the perfect time for this study.

In addition to contributing to the research about the topics of PSMs and analytics, which have yet to be fully explored, this study has implications for practical application. Examining students’ self-reported confidence and instructor-reported competence ratings could inform curricular support for developing the communication skills required to succeed as a graduate student and in future careers.
Abbreviations and Definitions

Numerous abbreviations and terms that are used throughout this study have different meanings in other contexts. The three most common abbreviations used are CTW, DKE, and PSM. CTW is the four-day long Communication Training Workshop. DKE is the Dunning-Kruger Effect. PSM is Professional Science Master’s. The definitions of terms used in the study appear below. The purpose of providing these definitions is to contextualize the terms used in the study.

Analytics: Analytics is used to describe the field that uses “the scientific process of transforming data into insight for making better decisions” (Gorman & Klimberg, 2014). The field of analytics (also sometimes called data science) is defined as the following:

“a new interdisciplinary field that synthesizes and builds on statistics, informatics, computing, communication, management, and sociology to study data and its environments (including domains and other contextual aspects, such as organizational and social aspects) in order to transform data to insights and decisions by following a data-to-knowledge-to-wisdom thinking and methodology” (Cao, 2017, p. 8).

Communication: Communication is one of the many soft skills desired by academics and professionals. Although often in a category of its own, communication can be considered a leadership skill (Griffiths, 1995) or as a part of teamwork, relationship building, customer service, or interpersonal skills (Rainsbury, Hodges, Burchell, & Lay, 2002). For this study, communication is its own soft skills category. Although communication skills could be subdivided into many parts (written, oral presentation, interpersonal, non-verbal), the focus for this study is on oral presentations and is most often shortened to just the word presentations.
**Competence**: In this study, competence is defined as ‘the combination of knowledge, skills and attitudes needed to speak in public in order to inform, self-express, to relate and to persuade” (De Grez, 2009, p. 5). This definition of communication competence is used throughout the study.

**Confidence**: For this study, confidence is defined as the “feeling of assuredness and lack of anxiety” (Compte & Postlewaite, 2004 p. 1539) as related to presentation skills. For this study, confidence is indicated by a self-assessed rating of one to five by the students.

**Incompetence**: Although the term incompetence may sound overly harsh, in the context of this study, incompetence is use to indicate when a person “performs poorly in a specific domain” (Dunning, 2005, p.16). Incompetence is situational and does not doom one to being incompetent in all areas for all time. Kruger and Dunning (1999) warn that we are all incompetent in different areas and that incompetence is a matter of degree. For this study, incompetence is used to indicate those students who struggle to deliver presentations.

**PLUS courses**: PLUS courses are the non-technical courses required of PSM degree programs that can include soft skills such as business, ethics, leadership, and communication (Gitig, 2010).

**Soft skills**: Soft skills are complementary to technical or hard skills (Rainsbury et al., 2002) and include collaboration, teamwork, leadership, interpersonal, and communication skills such as delivering presentations. Although it is acknowledged that soft skills are difficult to teach and not easy to master (Laker & Powell, 2011; Peterson et al., 2014; Weedon & Tett, 2013), the use of the term “soft” seems to undermine the importance of these skills. Other terms used in place of soft skills include employability skills, professional skills,
21st-century skills, or workplace skills. However, none of these have been consistently embraced or used. As a result, the term soft skill will be used in this study to refer to skills related to communication and more specifically presentations.

**Delimitations**

This study was designed to examine students’ self-reported confidence and the relationship to instructor-rated competence with presentation skills. Motivation, general self-confidence, trait communication anxiety, and mental health concerns could all be relevant for further investigation into the issues that influence confidence and presentation skill development; however, these issues are outside the scope of this particular research study. In addition, the findings of this study are bound by the population and sample (students from one PSM degree program in analytics at a large research university in the South). By defining the limits that form the boundaries of this research study, some misunderstandings can be avoided (Punch, 2006).

**Positionality**

A careful consideration of research positionality and a positionality statement are expected in a qualitative research study (Atkinson & Sohn, 2013; Bourke, 2014; Milner, 2007). The positionality of the researcher influences the methods, analysis, and interpretation of the findings. Jafar (2018) suggests that quantitative research would benefit from positionality statements. Although not a typical section in a quantitative study, the nature of this quantitative research suggests that a positionality statement is appropriate and necessary. Coming from a constructivist point of view, which this researcher does, situating the research within the context helps to explain the findings and the implications. The following positionality statement defines “the boundaries within which the research was produced” (Jafar, 2018, p. 323).

The research study was based on communication reflection assignments and
presentations by the researcher’s students. The researcher teaches communication classes (both writing and speaking) and had a teacher-student relationship with the subjects of the study. By noting the relationship, the researcher hopes to assuage any misgivings about the authenticity of the participants’ responses by addressing the situation in order to “allow the reader to better understand how the individual researcher might have arrived at the particular interpretation of the data” (Merriam, 2002).

For this study, the researcher implemented best practices of the Scholarship of Teaching and Learning (SoTL): inquiry focused on student learning, grounded in context, methodologically sound, conducted in partnership with students, and appropriately public (Felten, 2013). The reflection assignments and presentations that this research was based on have been an integral part of the researcher’s teaching portfolio for the past twenty years. The researcher began teaching at the university level the same year that Kruger and Dunning published their study about confidence and competence. Although the researcher did not begin by collecting formal data about students’ feelings of confidence about presentations, she did have students reflect on their reactions and feelings about presentations and used that information to help create better learning opportunities and practice opportunities for improving presentation skills. Over the years, the researcher implemented a more systematic reflection process by using sticky notes to indicate feelings of confidence prior to presentations as shown in Figure 1.3.
Figure 1.3: Self-reported presentation confidence rating during three-day Communication Training Workshops used different colored sticky notes from class of 2017 and class of 2018.

In both images, the range is “more confident” on the left, “less confident” on the right. The labels used were “We got this” or “I got this” for the confident side of the board. On the less confident side of the board, the label was “We’re shaking in our boots” or “I’m shaking in my boots.” Different colors were used each day. At the start of the CTW, blue sticky notes established the baseline. On day two, students used yellow sticky notes. Day three was orange sticky notes. This display remained on the board throughout the CTW and served as the basis for discussion.

Although the sticky notes provided an engaging visual that sparked conversation and additional reflection, at the end of the CTW, the sticky notes had to be removed and the data about confidence with presenting was only recorded in the form of pictures. In addition, the
The sticky note approach did not provide enough data to form any conclusions because it was impossible to track where students placed their sticky notes each day. Eventually, the student confidence reflection process was morphed into a Google form that made it easier for both the researcher and the students to track trends. In the Google form, students were asked to rate their confidence on a scale of one to five (one being the least confident and five being the most confident). Figure 1.4 shows how the responses from the Google form were displayed and shared with the students.

Figure 1.4: Self-reported presentation confidence rating from initial assessment Google form converted into pie chart.

Ultimately, the researcher’s interest in student confidence and competence with presentation skills served as the spark for the research study.

The researcher strives to consider the ways that her own experiences and situation influence her teaching and her research. As a white, upper middle class, cisgender female, she is aware that she carries that invisible backpack of white privilege (McIntosh, 1988) while simultaneously balancing the impact of sexism. She tries to remember that her race and class (along with age and title) have an impact on the ways that she teaches and ultimately how her
students respond to her. However, she is keenly aware how her sex plays a significant role in her teaching. In the male-dominated field of analytics, she often feels the need to prove herself (and her content) when teaching a mostly male audience. Although the current PSM program has a close to even split of male and female students, this has not always been the case. She is compelled to introduce content with a feminist approach with the goal of improving everyone’s experience, not just the experience of the women in her classes.

The biggest challenge the researcher faced while doing this research was suspending her own ideas about students’ beliefs about their communication confidence and competence. After twenty years of teaching professional communication skills to undergraduates, graduates, faculty, and professionals, the researcher has developed her own theories about students’ communication skills. However, the researcher can look to how her experience as a teacher has been influenced by becoming a parent. In the role of parent, she is constantly challenged to adjust her theories about skill development by how each child approaches the same task in different ways. She can apply this same mindset to this research.

The researcher’s experiences with her own presentations are overwhelmingly positive. She took a speech and debate classes in high school and competed (sometimes successfully) in regional speech competitions. In college and graduate school, she actively sought opportunities to present through classes and through work in residence life. She began teaching professional communication in 1999 and has taught, presented at conferences, delivered short and long-term workshops, presented at schools and professional organizations, given a TEDxNCSU talk, hosted numerous conferences, served as Emcee for symposiums, done several Pecha Kucha talks, performed at and co-hosted a local open mic, and presented Peer Scholar workshops. She is energized, excited, and engaged when preparing for and giving a presentation and looks forward
to the next opportunity. She believes that many (or maybe most) of her students do not feel the same way.

**Summary**

PSM programs require communication skills as part of the curriculum in order to help graduate students develop necessary workplace skills. PSM students need to have strong presentation skills to be successful in their future careers. Examining PSM students’ self-rated confidence with presentation skills and analyzing and comparing those ratings to instructors’ ratings of presentation competence could help inform future curriculum decisions about PSM communication offerings. This study examined students’ self-assessed confidence ratings and instructors’ competence ratings within the theoretical framework of the DKE.

Chapter one detailed the statement of the problem, the purpose of the study, the five research questions that guided the study, an overview of the research methodology, an introduction of the DKE as the theoretical framework, the conceptual framework, the setting, the significance of the study, definitions, and delimitations. Chapter one also included a positionality statement, a section that may be considered unusual for a quantitative study. However, because this study used the researcher’s students as the participants in the study, it is appropriate and necessary to include this section.

Chapter two provides an overview of the literature on confidence, competence, and the DKE. In addition to providing details about DKE and the findings that may be relevant to this study, chapter two also presents the ways that the popular press has altered the DKE and made it into something quite different from the original study.
Chapter three details the methodology and how it is influenced by SoTL. In addition, chapter three provides details about the population, variables, data collection, and the analysis steps.

Chapter four presents the findings for each of the five research questions. Median, mode, percents, Spearman’s correlation, and regression were used to analyze the data collected from the students’ confidence ratings and the instructors’ competence ratings. Findings include the students’ confidence ratings, instructor competence ratings, the comparison between students’ ratings and instructors’ ratings including significance, and an analysis of the factors of sex and age on the ratings.

Lastly, chapter five provides conclusions and recommendations based on the findings of the research study. A discussion of the limitations of the study and possible future research studies that could expand this work are provided.
CHAPTER 2: LITERATURE REVIEW

“It is surprisingly difficult to form accurate impressions of self” (Dunning, 2005, p.3).

Introduction

This study focused on professional science master’s (PSM) students’ confidence and competence with presentation skills. The purpose of this chapter is to provide an overview of the literature about the theoretical framework of confidence and competence based on the Dunning-Kruger Effect (DKE) that examines the tendency for some people to hold “miscalibrated views about themselves” (Kruger & Dunning, 1999, p. 1132). This chapter is divided into five sections. The first section provides an overview of confidence with an emphasis on self-reported or self-assessed confidence. The second section discusses competence with an emphasis on instructor-rated competence. The third section focuses on the discrepancies that can often exist between confidence and competence as illustrated by the DKE. In addition to describing the DKE and how it has been used in similar research, this section will also address the concerns of critics of the DKE and Dunning and Kruger’s response to their critics. The end of the third section discusses how the DKE has been embraced outside of academia and how popular press has morphed the original effect presented by Kruger and Dunning’s 1999 study. The fourth section provides an overview of two competence models that share some similarities with the DKE, Noel Burch’s Conscious Competence Model, and Julie Hays’ Competence Curve. Chapter two concludes with the need for PSM students to possess confident and competent presentation skills.

Confidence

Confidence ratings are frequently used in research (Keller, 2016) and the concept of confidence is generally familiar. However, despite its commonality, researchers embrace many different definitions of confidence (Oney & Oksuzoglu-Guven, 2015). One way to define
confidence is through self-efficacy. Self-efficacy is self-confidence in a specific situation and refers to the belief of what “one can do with what one has” (Bandura, 1983, p. 467). For this study, self-efficacy may play an important role in the situation of giving a presentation because “the level and strength of perceived self-efficacy in public speaking will differ depending on the subject matter, the format of the presentation, and the types of audiences that will be addressed” (Bandura, 1977, p. 203). Some researchers make the distinction that self-efficacy is domain specific and that confidence can be broader (Stankov, Kleitman, & Jackson, 2014). However, this distinction is based on a general overall feeling or state of self-confidence and not confidence in executing a particular skill such as delivering a presentation. Jiang & Pell (2017) use confidence to mean the feeling of knowing and a lack of doubt. This lack of doubt can be considered positive or it can manifest as negative in the form of overconfidence (McRaney, 2014; Sanchez & Dunning, 2018). There are “three distinct ways in which the research literature has defined overconfidence: (a) overestimation of one’s actual performance, (b) overplacement of one’s performance relative to others, and (c) excessive precision in one’s beliefs” (Moore & Healy, 2008, p. 502). This study focused on the issue of overestimation. However, overplacement or better-than-average may also have some implications in the study. Overprecision is also relevant because of a students’ certainty about the accuracy of their beliefs. For this study, confidence is defined as the “feeling of assuredness and lack of anxiety” (Compte & Postlewaite, 2004 p. 1539) as related to presentation skills.

**Self-assessed Confidence**

Self-assessment is an important and complex concept in higher education (Atir, Rosenzweig, & Dunning, 2015; Eva, Cunnington, Reiter, Keane, & Norman, 2004). Self-assessment “occurs when learners make judgements about aspects of their own performance”
(Boud & Falchikov, 1989, p. 530). The driving interest in using self-assessment in the higher education classroom is to support lifelong learning (Boud & Falchikov, 2006) and for students to become “better judges of their own work” (Boud, Lawson, & Thompson, 2013, p. 941), which in turn should result in more insight (Zell & Krizan, 2014). Self-assessment can be considered an important aspect of critical reflection in order to make improvements in performance (Marienau, 1999). However, despite the interest in self-assessment and the potential positive results of students being able to accurately self-assess, studies find that self-assessment and assessment done by external experts or instructors often do not match (Bernardo et al., 2018; Campbell, Mothersbaugh, Brammer, & Taylor, 2001; De Grez, Valcke, & Roozen, 2012; Warwick & Howard, 2015). Often these studies ask students to predict a certain grade and then compare that to the assessed grade (Boud & Falchikov, 1989). However, other self-assessment studies use students’ confidence ratings and compare them to competence ratings done by external experts. The approach of looking at confidence and competence ratings has been examined in numerous studies with medical students and has shown a lack of correlation between self-assessment and external ratings by experts (Berg, Majdan, Berg, Veloski, & Hojat, 2011; Davis et al., 2006; Dehmer et al., 2013; Duffy & Holmboe, 2006; Farooq, Mustafa, Akram, Khan, & Amjad, 2013; Gude et al., 2017; Minter, Gruppen, Napolitano, & Gauger, 2005; Patton, 2019; Ward, Gruppen, & Regehr, 2002).

Studies comparing self and instructor assessment of presentation skills reveal there is a disconnect between self-assessments and external assessments (Campbell et al., 2001; Ritchie, 2016). High performing students tended to rate themselves lower and lower performing students tended to rate themselves higher (Karnilowicz, 2012; Trofimovich, Isaacs, Kennedy, Saito, & Crowther, 2016). Similar findings were indicated by Kruger & Dunning's (1999) four studies that
asked students to rate their abilities and then have that rating compared to an external rating. Although many studies echo the same findings as Kruger and Dunning, one important difference must be addressed. Kruger and Dunning wrote: “gender failed to qualify any results in this or any of the studies reported in this article, and thus receives no further mention” (1999, p. 1123). However, other studies have found a difference in sex when it comes to self-assessment with females reporting lower confidence than males (Bengtsson, Persson, & Willenhag, 2005; Blanch, Hall, Roter, & Frankel, 2008; Langan et al., 2008; Litzler, Samuelson, & Lorah, 2014; Schulz & Thöni, 2016; Stankov, Lee, & Paek, 2009). Karatjas & Webb's (2017) study was split in regard to sex—male students predicted higher scores than female students except in the case of the poorest performing students. Poor performers did not show a difference based on sex.

This sex difference in confidence is an important aspect of this study. Females tend to report higher levels of communication anxiety than males (Behnke & Sawyer, 2000), which can negatively influence self-assessed rating of confidence in presentation skills. In addition, women in science, technology, engineering, and math (STEM) report lower career confidence than men (Cech, Rubineau, Silbey, & Seron, 2011), which can limit the number of women in STEM careers. Another study, although older, did not find sex to be a significant factor in predicting academic confidence in graduate students in science and engineering (Santiago & Einarson, 1998). The current study focused on graduate students in a highly competitive PSM degree program. The women in the PSM program have already exhibited their ability to persist in a male-dominated field; however, it is important to note that numerous factors influenced responses.
Competence

As with the definition of confidence, one agreed upon definition of competence does not exist (Dunning, Meyerowitz, & Holzberg, 1989). The term competence or competent used in this study is not to be confused with the concept of workplace competencies. Competencies can be considered sets of specific job-related skills that differ from what typical academic and intelligence testing can identify (McClelland, 1973). Often the discussion of competencies is wrapped up in the field of human resources and described as categories of skills or traits that are needed to perform a specific job or task in the workplace. Chouhan & Srivastava (2014) provide a list of sixteen definitions of competency spanning from the 1970s until 2012 that show the focus on sets of skills expected in the workplace. Although delivering a presentation is a required skill (or competency) for many of the jobs that the PSM students hope to have after graduation, for this study, the term competence is focused on the actual successful demonstration of the skill of delivering a presentation. For example, in a study of clinical medical students, the term competence or competent can be applied only when a student can complete a procedure successfully on his or her own or would be able to teach that procedure (Barnsley et al., 2004).

Story and Dunning (1998) equate competence with excellence, and this definition fits the way that competence is considered in this study. The focus of this study was on communication competence. Communication competence is defined as “the combination of knowledge, skills and attitudes needed to speak in public in order to inform, self-express, to relate and to persuade” (De Grez, 2009, p. 5). This definition of communication competence was used throughout the study. Communication competence was indicated by a rating of one to five determined by instructors as to how well students can demonstrate their ability to inform, self-express, relate, and persuade during their presentations.
**Instructor-rated Competence**

As noted above, student self-ratings and instructor ratings are often at odds. Different approaches are used to rate the competence of students’ presentation skills including self-assessment, peer-assessment, and instructor-assessment. Despite interest in self-assessment and peer feedback (Dochy, Segers, & Sluijsmans, 1999), in a study on developing oral presentation competence, the results “demonstrated the superiority of teacher feedback for encouraging students’ presentation behaviour” (van Ginkel, Gulikers, Biemans, & Mulder, 2017, p. 1671). Instructor feedback and assessment has been shown to be more reliable than peer assessments (Magin & Helmore, 2001). Of course, peer assessments of competence in presentation skills offer feedback that is relevant and appropriate as part of the target audience for the assignment. However, students tend to rate presentations higher than instructors for numerous reasons: lack of experience, lack of knowledge, lack of observational skills, and lack of anonymity (Suñol et al., 2016). Students can be trained to be better at self-assessment (Thawabieh, 2017), but for this study, the focus of assessment was on the instructors’ competence rating for presentation skills.

**The Dunning-Kruger Effect (DKE)**

This study was inspired by the work of Kruger and Dunning and what has become known as the Dunning-Kruger Effect (DKE). Kruger and Dunning (1999) posit that people who are unskilled in a certain domain overestimate their abilities and face the “dual burden” of being incompetent in that domain and also unaware of their incompetence. The miscalibration between self-assessment and actual ability is attributed to gaps in metacognition. Metacognition is the “ability to know how well one is performing, when one is likely to be accurate in judgment, and when one is likely to be in error” (Kruger & Dunning, 1999, p. 1121). In addition to issues with
bottom-performers overestimating their abilities, Kruger and Dunning also found that the top-performing participants underestimated their abilities.

In their 1999 article, Kruger and Dunning shared the results of four studies conducted to assess participants’ ability to self-assess and also to assess competence in others. They predicted that the lowest performing participants (those in the bottom quartile considered “incompetent” in the domain) would overestimate their abilities, be unable to identify competence, and lack the ability to accurately compare their performance. In addition, they predicted participants would acquire an understanding of their incompetence and thus be able to improve their metacognitive skills. Each of the four predictions were confirmed and their studies show that the incompetent overestimate themselves and are unaware of it and the skilled underestimate themselves and overestimate their peers. Before a brief discussion of each study, it is important to note the way that Kruger and Dunning use the term “incompetent.” The use of incompetent is not meant to indicate a total lost cause. Instead, Kruger and Dunning use incompetent to mean “people who are less competent than their peers… in specific domains” (1999, p. 1122).

**Study One: Humor**

In study one, a 30-joke questionnaire was given to 65 Cornell University undergraduates who were asked to rate the jokes on a scale of one to eleven. Those ratings were compared to the ratings assigned to the jokes by experts on humor (eight comedians). Participants then were asked to rank themselves on their ability to identify humor as compared to the average student. Kruger and Dunning determined each participants’ percentile rank based on the participants’ correlation with the comedians’ ratings. The results of this study showed that participants in the lowest quartile overestimated their ability. Those in the second and third quartile also
overestimated, but not to the degree that the bottom quartile did. Participants in the highest quartile underestimated their performance.

**Study Two: Logical Reasoning**

In their second study, Kruger and Dunning used logical reasoning because, unlike the humor study, the logical reasoning study had objectively correct answers. Similar to study one, in study two, 45 Cornell students completed a logic test based on the Law School Admissions Test (LSAT) and then they were asked to 1) compare their perceived logic ability to other students, 2) estimate their perceived score in comparison to their classmates, and 3) estimate their number of correct answers on the assessment. As in study one, participants in the bottom quartile overestimated their ability. Those in the top quartile underestimated their ability.

**Study Three: Grammar**

The two-phase study three on grammar assessed participants’ ability with American Standard Written English (ASWE). In phase one, 84 Cornell University students answered a 20-question test about grammar. At the conclusion of the test, participants were asked to rate their ability compared to their peers and estimate their test grade and the number of correctly answered test questions. Poor performers once again overestimated their scores and top performers underestimated their scores. In phase two of study three, the top and bottom performers \( n=36 \) were asked to grade their peers’ work. Participants were then asked to review their own test and re-rate themselves. Those in the bottom quartile did not improve their own assessment of their abilities even after seeing peers who performed well. Top performers, on the other hand, were able to assess their percentile ranking more accurately after seeing their peers’ work. Based on study three, Kruger and Dunning indicate that the “miscalibration of the
incompetent stems from an error about the self, whereas the miscalibration of the highly competent stems from an error about others” (1999, p. 1127).

**Study Four: Training**

To address the concern about regression effect (low performers overestimate their performance because they cannot underestimate their performance due to their scores being so low) influencing the results of the studies, Kruger and Dunning had 140 Cornell University students take a logic test, rate their ability, and estimate their grade. A group of 70 participants were randomly selected to complete logical-reasoning training. Afterwards, all participants were asked to review their tests and re-estimate their ratings. The results of study four echoed the findings from studies one through three. However, the participants in the bottom quartile who received the training were better able to identify their abilities. The top-quartile participants who received the training also adjusted the rating of their abilities. Those in the control bottom quartile group revised their responses incorrectly and those in the top quartile did not change their ratings.

The four studies conducted by Kruger and Dunning reify the concept of optimistic miscalibration of ability by the incompetent and the underestimation of ability by the top performers. Their studies show that the miscalibration of overestimation can be connected to a lack of metacognitive skill. This effect has implications beyond the studies of humor, logic, grammar, and training. The DKE can be seen and tested in many different domains.

**DKE Used in Other Studies**

The DKE is of interest to researchers in many different fields. According to Google Scholar, Kruger and Dunning’s 1999 article has been cited over five thousand times. In addition to the studies conducted by Dunning and many colleagues on the topics of grammar, logic,
humor, chess, debate, and exams, the DKE has been applied to many other fields. As mentioned in chapter one, DKE has been used in studies on alternative medicine, conspiracy theories, and media literacy (Plencner, 2014), high school standardized tests (Mattern et al., 2010), wine tasting (Aqueveque, 2018), the vaccine debate (Benegal, 2018; Motta et al., 2018), politics (Anson, 2018), literacy skills (Khalid, 2016), the peer review process (Huang, 2013), social justice (West & Eaton, 2019), bridge players (Simons, 2013), astronomy (Hester, 2017), undergraduate science majors (Karatjas & Webb, 2017a), workplace concerns (Gibbs et al., 2017), and medical competency (Hodges et al., 2001).

**Criticism of DKE**

Although DKE has been used by many researchers, it also has been the target of criticism. Of course, it is not unusual for theories, concepts, or ideas to be challenged in the academic literature. The criticisms have been rebutted; however, it is worth acknowledging and considering the critics and the responses from Dunning and Kruger and other researchers. Three criticisms of DKE will be briefly discussed: regression to the mean, noise plus bias, and signal extraction problem.

**Regression to the mean.** The first criticism comes from Krueger & Mueller (2002) — note the first author is Krueger, not to be confused with Kruger. Krueger and Mueller’s studies indicate that “errors in the predictions of one’s own performance can be explained by the regression of these predictions to an overall inflated mean” (2002, p. 185). In addition to regression to the mean, Krueger and Mueller cite the above average effect or better than average (BTA) as being responsible for the DKE. Taking this approach, it would not be unusual for top performers to underestimate themselves and bottom performers to overestimate.
Noise-plus-bias. Burson, Larrick, & Klayman (2006) proposed a noise-plus-bias model where noise is the irregularity or variation in data caused by randomness—in this case the “judgments are noisy”—and bias is “task-induced bias” (p. 61). The noise-plus-bias model attempts to explain the discrepancies between actual skill level and self-assessed ability. Burson, Larrick, and Klayman conducted three studies that lead them to state that noise-plus-bias model of judgment expands the work of Kruger and Dunning and of Krueger and Mueller as well as helps to better explain the discrepancies between actual skill level and self-assessed ability. They acknowledge the appeal of DKE and note that Krueger and Mueller’s criticism does not provide a definitive answer either. Instead, Burson, Larrick, & Klayman (2006) focus on the perceived difficulty of a task and propose that all participants “are equally poor at estimating their relative performance…overestimating their percentile on tasks that are perceived to be easy and underestimating it on tasks that are perceived to be hard” (p. 61). Their noise-plus-bias model indicates that Kruger and Dunning’s ideas about metacognition are supported in some instances.

Signal extraction problem. Krajc and Ortmann (2008) argue that the DKE, instead of an issue with metacognition, is a signal extraction problem that is exhibited differently for skilled and unskilled participants. According to Krajc and Ortmann, the lower skilled participants have an inference problem that can be addressed through feedback. In addition, because Kruger and Dunning studied students at an elite university, Krajc and Ortmann suggest the results are just a backwards j-distribution, which shows many poor performers at the bottom level and a thin tail at the higher level (Schlösser, Dunning, Johnson, & Kruger, 2013).

Defense of DKE

Despite the challenges to Kruger and Dunning’s research, other researchers support their findings. Regression to the mean cannot explain the difference between the effect for the lower
performers in comparison to the effect for the higher performers (Yarkoni, 2010). McIntosh, Fowler, Lyu, and Sala (2019) report that “none of our findings cast doubt on the DKE as an empirical phenomenon” (p. 15). Feld, Sauermann, and de Grip (2017) support DKE, but they also indicate the importance of “taking measurement error into account” (p. 23), which they define as luck. Kruger and Dunning (2002) responded to Krueger and Mueller’s criticism with criticism of their own: claiming Krueger and Mueller used unreliable tests and inappropriate measures. Dunning (2015) also defended their work and examined and tested the alternative theories. Schlösser, Dunning, Johnson, & Kruger (2013) stated that only a small portion of self-assessment errors might be accounted for by the Krajc and Ortmann model.

**Popular Press**

The Dunning-Kruger Effect was named for Kruger and Dunning, but it was not named by Kruger and Dunning. Dr. Dunning joked in a video done by Cornell’s Science Media Production Center that “if you don’t name the effect, it turns out that someone is going to name the effect after you.” (“We are all flawed intellects: How can we judge the expertise of self and others?,” 2017). The effect that they found in their four studies was deemed the “Dunning-Kruger Effect”—forever linking their names to the study of incompetence.
The DKE has found its way into popular press, and in doing so has been altered in quite a dramatic way. Doing a Google image search for “Dunning-Kruger Effect” results in dozens and dozens of graphs incorrectly attributed to Dunning and Kruger. Figure 2.1 shows the first page of a Google search from August 2019.

Figure 2.1: Google images search of Dunning-Kruger Effect.

The first three rows of results show a similar graph that is labeled as the “Dunning-Kruger Effect.” According to these images, the DKE shows a spike in confidence for someone without experience. Then, that confidence dips as experience increases. Finally, the confidence begins to rise with experience. According to these graphs, the beginners’ confidence is higher than the experts’ confidence.

A closer examination of one of the images in the top three rows of the search results shows that not only is the image labeled with Dunning and Kruger’s names, but also includes the
title and year of their study. Figure 2.2 looks like a legitimate display of the DKE and its source from Kruger and Dunning’s 1999 article.

![Dunning-Kruger Effect Diagram](image)

**Figure 2.2: Incorrectly attributed graph.**

Without any knowledge of the actual study, a reader could be convinced that this is the correct version of DKE. Some of the elements are there—confidence on the y-axis and competence (as indicated by none-experience-expert) runs along the x-axis. However, those familiar with the actual DKE will notice the lack of the words “perceived” and “actual” that Kruger and Dunning use in their study. The DKE also uses the words “incompetent” and “competent,” which do not appear on this visual. Kruger and Dunning discuss “experts” and use that term alongside “competent” in their study, so that element of this incorrect visual is consistent with the DKE. However, other terminology does not match. Kruger and Dunning use the term “novice” and “beginner” instead of the range from “none to expert.” The humorous take away is that unless readers are competent in their knowledge about the DKE, they are unaware that this visual is incorrect and that it misrepresents what Kruger and Dunning showed in their studies.
In Figure 2.3, the incorrect image is associated with the DKE from a Medium article by Weisert (2015) along with a false claim about an award for Dunning and Kruger.

Figure 2.3: Incorrectly attributed graph and prize.

First, it is important to note that at the intersection of experience and confidence, the label is “No nothing.” It is possible that was intended to be “know nothing” and is a simple typographical error. In addition to the typo and the incorrect image, the caption under the correct title of the research article indicates that Kruger and Dunning won the Nobel Prize for Psychology in 2000. However, there is not a Nobel Prize for Psychology (“Psychological scientists awarded Nobel for discovering brain’s GPS,” 2014). Instead, Dunning and Kruger were acknowledged in 2000 for their study by being awarded an Ig Nobel Prize from the Annals of Improbable Research. Ig Nobel Prizes “honor achievements that make people LAUGH, and then THINK. The prizes are
intended to celebrate the unusual, honor the imaginative — and spur people’s interest in science, medicine, and technology” (“About the Ig Nobel prizes,” 2019).

In addition to the incorrect shape of the graph, some versions of the incorrectly attributed figure include labels like “Mt. Stupid” and “Valley of Despair” and the “Slope of Enlightenment.” These are not concepts discussed in Kruger and Dunning’s study. Figure 2.4 shows a labeled version of an incorrectly attributed visual.

Figure 2.4: Graph incorrectly attributed to the Dunning-Kruger Effect.

The dual burden that Kruger and Dunning wrote about seems to be playing out in the popular press—being incompetent by displaying the wrong image and the wrong award and being unaware of the errors.

It is not until the fourth row of Google image search results that one of the actual figures from Kruger and Dunning’s (1999) study appear. Figure 2.5 show three of the actual images from Kruger and Dunning’s research.
Figure 2.5: Composite of Kruger and Dunning’s actual figures.

These figures are quite different from the altered Dunning-Kruger Effect images. These figures show how the incompetent overestimate their skills while the competent underestimate their skills.

According to Shaun Bennett, research librarian at NC State University, the first search for the phrase “Dunning-Kruger Effect” was in 2004. The correct figures appear in searches in 2009 through 2010. However, in 2011, a comic strip by Weinersmith introduced the concept of “Mt. Stupid,” which had some connection to the overconfidence work that Kruger and Dunning conducted. Figure 2.6 shows the comic that seems to be the origination of “Mt. Stupid.”

Figure 2.6: Mt. Stupid comic.
In 2012, a blog called Artivist (“Dunning Kruger Effect,” 2012) includes both the incorrect and correct figures but does not make any distinction between the two. It seems that the first (incorrect) figure was then spread to blogs and eventually became associated with the Dunning-Kruger Effect. Dr. David Dunning indicated that he was unaware of the origin of the incorrect figure (personal communication, June 2, 2019). However, he and a colleague decided to test the Mt. Stupid version of the Dunning-Kruger Effect. Sanchez and Dunning (2018) conducted six studies to examine beginners’ confidence. In short, they found that the Mt. Stupid model does have some merit because beginners’ confidence exceeds their actual performance.

Kruger and Dunning’s work, while misrepresented in many different forms, is a fascinating concept that captures many people’s attention. Although the incorrect graphs do not tell the full story of Kruger and Dunning’s research, they certainly provide another example of people overconfident in their skills displaying incompetence in their work.

**Other Models of Competence**

Many theories about competence and confidence were considered at the start of this study. Although the DKE seems to be the most relevant to the study because of the combination of overestimation by the lowest performers and underestimation by the highest performers, two alternative models were considered: Noel Burch’s Conscious Competence Ladder and Julie Hay’s Competence Curve.

**Conscious Competence Ladder**

The Conscious Competence Ladder is often attributed to Noel Burch and Gordon Training International (1970). However, other sources include a 1966 report from Bombay’s Department of Education or a 1974 Canadian Training Methods journal. As demonstrated with the discussion of the Mr. Stupid version of the DKE, the source of the Conscious Competence
Ladder is debatable and unclear (Comeaux, 2013). However, the four parts of the ladder are consistent, no matter the original source. The Conscious Competence Ladder has four levels: unconsciously unskilled, consciously unskilled, consciously skilled, and unconsciously skilled. At the first stage, confidence is higher than actual competence. At the second stage, people are aware they are lacking skills. At the third stage, people can demonstrate their skills with effort. At the final stage, people see their skill as effortless. The ladder is a useful metaphor to consider the development of skills. Movement up and down the ladder is possible depending on experiences and complexity of tasks. What is lacking in this model is a way to measure or track where a learner falls on the ladder. Sharing similar ideas with the DKE, the Conscious Competence Ladder is an interesting way to categorize competence, but not a relevant way to analyze student confidence and competence ratings when considering the issues of overestimation and underestimation. Also, because the intent of this study is to compare and determine any relationship between self-assessed confidence and instructor-assessed competence, the DKE is the more appropriate model.

**Competence Curve**

The second alternative competence model that was considered is Hay’s competence curve. Hay's (1991) competence curve appeared in an article about organizational change. The competence curve includes seven stages: immobilisation, denial, frustration, acceptance, development, application, and completion. Figure 2.7 shows the Competence Curve with the stages labeled and the competence increasing as people move through time and the seven stages.
The seven stages are begun after a change (marked as Change Point and the intersection of the x and y axis). Moving through the stages ends in a feeling of no longer being aware of the change. Although it is possible that many students may relate to the feelings of immobilisation, denial, and frustration when forced to work on their presentation skills, this model is focused on change and not on self-assessment. In addition, the model is not comparing to outside experts’ assessment of positive movement on the competence curve. Even though both models share some similarities with the DKE, the underestimation and overestimation of skills is the focus of this study. Once again, the DKE proves to be the more appropriate model for the study.

**PSM Students’ Need for Confident and Competent Presentation Skills**

As discussed in chapter one, PSM students are expected to have a combination of both technical and professional skills (Koenig, 2011; Petrone, 2019; Phillips & Phillips, 2015; Rao,
The expectation is that the students need to become confident and competent presenters—able to share their technical knowledge with a wide variety of audiences with different levels of conceptual understanding (Lee et al., 2016; Sageev & Romanowski, 2001; Zhang, 2012). Data analytics professionals have to be able to explain their analysis and findings through presentations that are understood by a wide variety of audiences (Dubey & Gunasekaran, 2015). Data analysts may find themselves working in marketing, medicine, banking, retail, sports, insurance, and many other fields. To succeed in any of these fields, strong presentation skills are needed (Arora, 2017; Marcel, 2015).

Part of developing into confident and competent presenters is the ability to accurately self-assess presentation skills. As the DKE indicates, the lowest performers tend to overestimate their skills, while the highest performers tend to underestimate their skills. In addition, people’s beliefs about their skills do not always indicate that their performance will match their self-image.

**Summary**

In this chapter, theories about confidence and competence were presented and reviewed. The literature about confidence was reviewed with an emphasis on self-assessed confidence. For competence, the literature reviewed focused on instructor-rated competence. Because the DKE serves as the theoretical framework and inspiration for this study about presentation confidence and presentation competence, the original 1999 research with the four studies (humor, logic, grammar, training) was reviewed with the relevant findings highlighted. Other studies using the DKE were presented in order to provide support for the theory and legitimate use in a wide variety of fields. In addition, a discussion of the criticism of DKE was included to address
concerns that could have the potential to influence the study. Each of the concerns were answered either by Dunning’s own responses or by other researchers who verified the DKE.

A significant part of chapter two was devoted to the alteration of the DKE by the popular press. The complete hijacking of the “Dunning-Kruger Effect” title and its association with a graph that was not actually created or used by Kruger and Dunning is important to this study. Some people may have previous knowledge of the DKE; however, that knowledge may be based on the wrong information. The brief summary of the origin of the incorrect visual was provided to eliminate confusion.

Chapter two also considered two other models of competence—Noel Burch’s Conscious Competence Ladder and Julie Hay’s Competence Curve. While both models provide interesting and relevant information for this study, they do not provide the focus on overestimation and underestimation. The study is intended to examine students’ overestimation and underestimation of their presentation skills. Therefore, the DKE is the most appropriate model for this study.
CHAPTER 3: METHODOLOGY

“...good practice in SoTL requires the intentional and rigorous application of research tools that connect the question at the heart of a particular inquiry to student learning” (Felten, 2013, p. 123).

The purpose of this chapter is to explain the research design and methods used in this study. To begin, this chapter opens with a brief acknowledgment of the influence of the Scholarship of Teaching and Learning (SoTL) on this study. Following the discussion of SoTL, this chapter presents the research design and its appropriateness for the study. Next, the chapter includes a discussion of the five research questions, the variables used in the study, and the population studied. Descriptions of the instrument and the methods of collecting data about confidence and competence with presentation skills are provided. The data analysis steps are detailed for each research question. The chapter concludes with a discussion of ethical issues and a brief summary.

Methodology Influenced by SoTL

According to Boyer (1990), the priorities of the professoriate are to the scholarship of discovery, integration, application, and teaching. From these overlapping priorities sprang the idea of SoTL. In his online SoTL resources, Voelker (2016) shares Anthony Ciccone’s definition of SoTL as the “scholarly inquiry into student learning that advances the practice of teaching” (p. 1). This research study takes its cues from the SoTL best practices because of the researcher’s interest in examining her own students’ self-assessed confidence and the instructors’ rating of competence. Considering Hutchings' (2000) SoTL taxonomy of questions (what works, what is, visions of the possible, and theory building) this study is related to the “what is” question in that this study seeks to describe the situation with students’ self-rated confidence and how that compares to instructor-rated competence using a systematic and data-driven approach guided by
best practices. This study aims to follow Felten's (2013) principles of good practice in SoTL: inquiry focused on student learning, grounded in context, methodologically sound, conducted in partnership with students, and appropriately public. Although SoTL is relatively new with many different approaches and research methods (Miller-Young & Yeo, 2015), “regardless of the methods employed, good practice in SoTL requires the intentional and rigorous application of research tools that connect the question at the heart of a particular inquiry to student learning” (Felten, 2013, p.123). For this study, archived artifacts will be used as direct forms of evidence (Friberg, 2019). The archived artifacts are student reflection exercises, instructor ratings, and demographic details.

**Research Design**

The study was a longitudinal, non-experimental quantitative research design using a single-question reflection assignment as the questionnaire. Longitudinal studies “collect data from the same population over time… the population is surveyed multiple times at specified intervals” (Cottrell & McKenzie, 2010, p. 197). Because the exact same students were studied at multiple points, the type of longitudinal study was considered a panel study (Ravid, 2014). This longitudinal study allowed an examination of any changes that occurred in the student population (Sproull, 1995) and the similarities and differences between students’ self-assessed confidence ratings and instructors’ competence ratings.

Cottrell & McKenzie (2010) defined non-experimental research as being used to “examine the knowledge, attitudes, beliefs, and behaviors of people” (p. 194). The intention of the study was not to look for a cause and effect relationship or test an intervention as in an experimental study (Creswell, 2013); rather, the purpose was to explore the correlations between the beliefs that professional science master’s (PSM) graduate students have about their own
confidence with their presentation skills and their competence as rated by three instructors. A non-experimental design was appropriate for this study because the intent of the study was to examine correlation or association among variables and not causation (Sproull, 1995).

The individual questionnaire used in the study was administered multiple times. The first time it was administered was online as part of students’ initial assessments. Maurer (2018) defined questionnaire as “one type of measure that can be used with survey methods in which the measure is self-administered by the participants (i.e., the participants read through the questionnaire and answer the questions at their own pace)” (p. 72). Students completed a number of assessments prior to the start of the academic program including a communication assessment. The purpose of these assessments was purely diagnostic in nature, which means that the assessment was intended to provide information for the instructors about the prior experiences of students and their needs (Scaife & Wellington, 2010). Students were instructed not to study for the assessments and were assured that no grades were associated with their responses. For this study, one question from the communication assessment was asked about their confidence rating with their writing and presenting skills. The focus of this study was on the students’ confidence rating for their presentation skills.

In addition to the reflection included in the initial assessment, students submitted their reflection response of their self-assessed confidence rating multiple times. For this study, the focus was on the following four reflections: before starting their graduate program, at the beginning of their graduate program, at the start of the Communication Training Workshop (CTW), and at the end of the CTW. For the first measurement, students were asked to provide a response in the form of a rating of one to five (one being “not confident” and five being “very confident”) to the prompt: “Confidence with Presenting.” For the second, third, and fourth points
of measurement used in this study, the students were prompted to provide a response in the form of a rating of one to five (one being “not confident” and five being “very confident”) to the prompt: “How confident do you feel about you presenting skills right now?” The slight change in the prompt was made to focus the students’ rating on their current feelings about their confidence with presenting. The four instances of completing the reflection were spread out over approximately five months, although the third and fourth instances were only separated by three days.

**Research Questions**

The study used a quantitative research survey design to examine PSM graduate students’ confidence in their presentation skills and their competence as rated by three instructors. Five research questions guided the study:

- Research Question 1: What are the students’ self-reported confidence ratings as measured four times within five months of their presentation skills?
- Research Question 2: What are the instructors’ competence ratings of students’ presentation skills?
- Research Question 3: How do students’ self-reported confidence ratings as measured four times within five months compare (equal to, overestimated, or underestimated) to instructors’ competence ratings?
- Research Question 4: Is there a statistically significant relationship between students’ self-reported confidence with presentation skills and instructors’ rating of their presentation competence?
- Research Question 5: Do sex and age significantly influence students’ self-assessed presentation confidence ratings?
**Variables Used in the Study**

The variables used in the study are the confidence ratings by the students, the competence ratings by the instructors, sex, and age. Table 3.1 shows the variables for each of the five research questions.

Table 3.1

*Variables Used for the Five Research Questions*

<table>
<thead>
<tr>
<th>Number</th>
<th>Research Question</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What are the students’ self-reported confidence ratings, as measured four times over five months, of their presentation skills?</td>
<td>Confidence = Descriptive</td>
</tr>
<tr>
<td>2</td>
<td>What are the instructors’ ratings of students’ presentation competence levels?</td>
<td>Competence = Descriptive</td>
</tr>
<tr>
<td>3</td>
<td>How do students’ self-reported confidence ratings as measured four times within five months compare (equal to, overestimated, or underestimated) to instructors’ competence ratings??</td>
<td>Confidence = Descriptive, Competence = Descriptive</td>
</tr>
<tr>
<td>4</td>
<td>Is there a statistically significant relationship between students’ self-reported confidence with presentation skills and instructors’ rating of their presentation competence?</td>
<td>DV = Competence Rating, IV = Confidence Rating</td>
</tr>
<tr>
<td>5</td>
<td>Do sex and age significantly influence students’ self-assessed presentation confidence ratings?</td>
<td>DV = Confidence Rating, IV = Sex, Age</td>
</tr>
</tbody>
</table>

Predictor variables were used because this study is using supervised learning in order to try to predict outcomes. The ratings of one to five for confidence and competence are ordinal variables because the responses from the students and instructors can be “placed into mutually exclusive categories and be ordered into a greater or less than scale” (Sproull, 1995, p. 70). Although Likert scale data is considered ordinal, it is acceptable to treat Likert scale data as interval for analysis (Carifio & Perla, 2008; Grace-Martin, n.d.; Jamieson, 2004; Lani, 2019; Leppink, 2019;
For this study, the assumption is that the four collections of Likert scale confidence ratings and the one collection of Likert scale competence ratings can be used to perform analysis typically reserved for interval data. Although the distance between numbers in the Likert scale data cannot be defined, Norman (2010) is unconcerned because “all the computer can do is draw conclusions about the numbers themselves” (p. 629). As a result, the findings must be interpreted appropriately, but that is not a reason to limit the use of statistics on Likert scale data such as was used in this study. In doing so, two assumptions are made: (1) the data is treated as interval, meaning it is assumed that the distance between each rating point is the same; and (2) the response variable is linear in respect to the number of the predictor variable.

**Population**

The participants in the study are a naturally formed (Creswell, 2013) group of graduate students in a PSM analytics program at a large research university in the southern United States. Approximately 230 students make up the entire study population. This number is sufficient for this study and for educational research, which typically recommends at least 30 participants (Ravid, 2014). The sampling method used is census because all the students are included in the target population (Daniel, 2012). One of the benefits of using student reflection assignment data is that the worry about low response rate is eliminated. The study used all the responses from ungraded assessments and reflective exercises (not tests or graded homework or classroom assignments) from PSM students in the class of 2019 and the class of 2020. Therefore, the estimated sample size for this study was approximately 230.

**Data Sources**

This study used two measurements: (1) student reflection responses collected four times consisting of ratings of one to five to indicate confidence with presentation skills and (2)
instructors’ ratings of one to five to indicate students’ competence with presentations skills. The student reflections were collected four times (during the initial assessment completed before the start of the graduate program, at the start of the graduate program, at the start of the CTW, and at the end of the CTW). The instructors’ ratings were collected once at the end of the CTW. Table 3.2 shows the timeline and source for each point of measurement.
Table 3.2

*Instrument, Timeline, and Source for Each of the Points of Measurement*

<table>
<thead>
<tr>
<th>Point of Measurement</th>
<th>Instrument</th>
<th>Time</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Question in Initial Assessment “Confidence with Presenting”</td>
<td>Prior to the start of the graduate program</td>
<td>Students’ ratings of their confidence with presenting on a scale of one to five with one being “Not Confident” and five being “Very Confident”</td>
</tr>
<tr>
<td>2</td>
<td>Reflection response to Communication Check-In “How confident do you feel about your presenting skills right now?”</td>
<td>Start of graduate program</td>
<td>Students’ ratings of their confidence with presenting on a scale of one to five with one being “Not Confident” and five being “Very Confident”</td>
</tr>
<tr>
<td>3</td>
<td>Reflection response to Communication Check-In “How confident do you feel about your presenting skills right now?”</td>
<td>Start of CTW</td>
<td>Students’ ratings of their confidence with presenting on a scale of one to five with one being “Not Confident” and five being “Very Confident”</td>
</tr>
<tr>
<td>4</td>
<td>Reflection response to Communication Check-In “How confident do you feel about your presenting skills right now?”</td>
<td>End of CTW</td>
<td>Students’ ratings of their confidence with presenting on a scale of one to five with one being “Not Confident” and five being “Very Confident”</td>
</tr>
<tr>
<td>5</td>
<td>Instructors’ ratings</td>
<td>After CTW</td>
<td>Instructors’ overall ratings of students’ competence based on students’ performance during the CTW’s four presentations</td>
</tr>
</tbody>
</table>

All points of measurement (student and instructor) used a five-point Likert scale to identify confidence and competence ratings. The five-point Likert scale was chosen for three
reasons. First, Likert-type scales are used to “estimate the [subjects’] overall attitude, opinion” (Sproull, 1995, p. 227), which is the aim of this study. Second, the choice of using four, five, or seven items on the scale was influenced by the goals of the study. For this study, the five-point Likert scale options map on exactly to the five possible grades (A, B, C, D, F) that are familiar to both students and instructors. Third, Matell & Jacoby (1972) found that a five-point Likert scale was scored faster by participants than a seven-point scale and that fewer “uncertain” choices were selected when using a seven-point scale. Because the reflection prompt does not suggest the possibility of an “uncertain” response, a seven-point scale is not needed. In a four-point scale, no option is available for a neutral or middle-of-the-road response. For this study, the middle value of three on a five-point scale does not indicate uncertainty, but rather an average or middle-of-the-road feeling of confidence. Therefore, the five-point scale is appropriate for this study.

**Measurement Instruments Considered and Rejected**

Although the focus of this study is on the analysis of existing student reflections (confidence ratings) and instructor assessment (competence ratings), many confidence and competence measurement instruments were examined and considered when developing this study. This section of the chapter provides a high-level overview of eight selected measures of confidence and/or competence that were considered and the reasons why they were not selected as the focus of the study or as an additional measurement tool.

**General confidence measures.** Stankov, Kleitman, & Jackson (2014) wrote an extensive review of nine different measures of confidence. Four of the measures in their cognitive confidence category had some connection to presentation skills. However, none of the physical confidence measures, self-efficacy measures, or performance measures that they reviewed were related to presentation skills. Although speaking skills were included in the nine domains of the
Personal Evaluation Inventory (PEI) and the six domains of the Individual Learning Profile (ILP), presentation skills were not the focus. The Academic Behavioral Confidence (ABC) scale includes only one statement related to presentations and the presentation in the inventory is not the same kind of presentations that the PSM students are expected to deliver. The ABC inventory asks about delivering a presentation to a small group of fellow students. Although the PSM students do present to small groups, they also must present to larger groups, faculty, and external audiences. The CAPA Confidence Inventory (CCI) examines confidence across 27 domains, one of which is public speaking. Overall, none of the reviewed measures met the exact needs of this study because they were not directly related to presentation confidence or competence.

Communication competence measures. James McCroskey maintained a repository of numerous communication research measures that were examined to determine if they would be relevant for this study. Although each of the following four instruments do examine some elements of confidence and competence with presentations, none of the instruments were solely focused on presentations or on the kinds of presentations that PSM students in this study are required to do. A brief description of each of the four measures appears below.

*Self-Perceived Communication Competence Scale (SPCC).* The SPCC is a self-assessment that measures perceived skill and not actual skill, which does match part of the intent of the study. McCroskey (n.d.) reports that the SPCC has good reliability and strong validity. Despite these positives, the SPCC is not a good match for the study because it asks about communication tasks outside of presentations that are not directly related to the curriculum of the PSM program. Nine of the twelve questions in the tool focus on casual conversations instead of presentation skills. Also, the use of a scale of 1-100 does not match the way instructors assign ratings in the PSM program.
**Personal Report of Communication Apprehension (PRCA-24).** The PRCA-24 is widely used to measure communication apprehension (CA), which is relevant to the study because CA could be considered the opposite of communication confidence, which is the focus of the study. According to McCroskey, PRCA-24 is reliable and valid. The PRCA-24 also uses a 1-5 scale that is consistent with the rating done by the instructors in this study. However, only a quarter of the statements in the PRCA-24 are about presentation skills. Like the SPCC, many statements that are about presentation tasks that are not consistent with the PSM curriculum. Only one statement used the word “confidence” in relationship to presentations. So, using the PRCA-24 would not add appropriate additional information to answer the research questions of this study.

**Personal Report of Public Speaking Anxiety (PRPSA).** The PRPSA is focused only on public speaking, which at first glance makes it a viable addition to the study. The statements in the tool include both positive (“I have no fear of giving a speech”) and negative (“While giving a speech, I get so nervous I forget facts I really know”) statements that could possibly be interpreted to indicate levels of confidence and competence in presenting; however, only one statement actually used the word “confidence.” The thirty-four statements of the tool are scored on a scale of 1-5 (one being the lowest, five being the highest). McCroskey reports alpha estimates > .90. The reason PRPSA was not selected as part of this study is because the outcome of the tool is to sort participants into just three categories of high, moderate, and low. Three categories may not capture the nuances that are needed for an examination of confidence and competence within the framework of the Dunning-Kruger Effect (DKE). In addition, only one of the statements used the word confidence.

**Willingness to Communicate (WTC).** The WTC offers a valid and reliable tool about communication. However, this tool does not provide enough relevant information for the study.
Participants rate twenty items on a scale of zero to one hundred. Of the three items that actually focus on presentations, only one of those items is related to the kinds of presentations the PSM students are expected to deliver. In addition, the outcome of this tool is to just separate students into two categories of high or low.

**Data Collection Steps**

All data for this study came from the PSM class of 2019 and the class of 2020. This means that the data collection happened during two time periods. The first data collection occurred between March 15-August 10, 2018 and the second collection occurred between March 15-August 9, 2019.

This study used student reflection data, instructor rating data, and demographic data. The student reflection assignment data and the instructor rating data was collected as part of the regular curriculum for the PSM students in this study. The demographic data was created when students enrolled in the PSM program. The researcher has access to all the data and was granted permission by the director and the university’s IRB office to analyze the data. In this section, details about how each kind of data was collected is followed by the process used to clean the data in order to analyze it.

**Collecting Student Reflection Assignments Data: Confidence in Presenting Rating**

The student reflection assignment data is a rating of one to five to indicate how confident the students feel about their presentation skills. The confidence rating was collected multiple times during the PSM program. Although the confidence ratings were collected during pre-program assessments and at the start of each communication class, this study is interested in four specific instances of this data collection: (1) prior to the start of the PSM program as part of the initial assessments, (2) at the beginning of the graduate program (3) at the start of CTW, and (4)
at the conclusion of the CTW. In each instance, students were asked to use a Google form to select on a scale of one to five how confident they felt about their communication skills.

For the initial communication assessment prior to the start of the program, students were asked to do some writing exercises, complete a reflective SWOT analysis, and report on their confidence with their communication skills. This study focuses only on the data collected about the student confidence scores. On the initial form, students were prompted to choose on a scale from one to five their “confidence with presenting.” A Likert scale with radio buttons were labeled one to five. Next to the number one, the words “Not Confident” were listed. Next to the number five, the words “Very Confident” were listed.

The results of the initial rating done prior to the start of the program were shared with the students at the start of the semester as a pie chart. The pie chart in Figure 3.1 shows the percentage of students who selected each rating category to indicate their confidence.

Figure 3.1: Confidence ratings by percentages shared with students at the start of the program.
Figure 3.1 served as a discussion topic about prior experiences with presentations. At that point, students were told that the reflection on their confidence with presenting would be collected and analyzed as a part of each communication class during their PSM program.

Once students arrived at the program, the rating remained the same, but the question was changed slightly to read: “How confident do you feel about your presenting skills right now? Select a score of 1-5.” Under the prompt, a Likert scale with radio buttons were labeled one to five. Next to the number one, the words “Not Confident” were listed. Next to the number five, the words “Very Confident” were listed. Data from the start of the graduate program, the first day of CTW, and the last day of CTW were collected and used for this study.

**Collecting Instructor Rating Data: Competence in Presenting Rating**

During the CTW, three instructors (including the researcher) observed and provided verbal feedback to the students on four different presentations: introduction, impromptu, 5-minute visualization, and team presentation. Two of the instructors were from the university and one was from industry. Students were broken into groups and were assigned a room for their presentations. After a group finished each type of individual presentation (introduction, impromptu, and 5-minute), the instructors rotated rooms. The rotation allowed each instructor to see one group in each of the individual presentation categories. All three instructors watched all the team presentations, which served as the culminating activity for the CTW. The instructors rated each of the students on their presentation skills on a scale of one to five. This rating was based on a set of ten criteria used to provide feedback: audience awareness, eye contact, filler words, gestures, posture, projection, movement, tone, facial expression, and presentation structure. Note: specific content was not part of the CTW. The CTW was designed to support presentation skills that can be used with content derived from their analytics courses.
The instructors have worked together for many years and have developed a close rapport. When they first started planning the CTW, they completed extensive norming exercises as a team to establish a consistent scoring system for competence ratings. Using a five-point scale is common for instructors because the ratings match the typical grades assigned to students: A, B, C, D, and F. Even though the five-point grading scale is familiar for the instructors, the ratings are not intended to be grades. To be clear and consistent, the instructors identified what each number of the rating scale indicates. Table 3.3 summarizes the rating, equivalent grade, description, and shortened descriptor used by the instructors to assign a rating of one to five for each presentation observed.

Table 3.3

<table>
<thead>
<tr>
<th>Rating</th>
<th>Equivalent Grade</th>
<th>Description</th>
<th>Shortened Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>A</td>
<td>Student is an expert speaker. Little to no change is needed. Will be a good example or mentor for other students.</td>
<td>Expert</td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>Student is proficient and has strong presenting skills. Some areas could be improved, but these improvements are minor or can be fixed with just a little improvement.</td>
<td>Proficient</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>Student has acceptable presentation skills, but also has areas for improvement. Skills are middle-of-the road.</td>
<td>Average</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>Student is a beginner in terms of displayed skills and needs assistance.</td>
<td>Beginner</td>
</tr>
<tr>
<td>1</td>
<td>F</td>
<td>Student requires significant and focused intervention.</td>
<td>Novice</td>
</tr>
</tbody>
</table>
Some of the terminology used for the shortened descriptor are borrowed from the Dreyfus model of skill acquisition (Dreyfus & Dreyfus, 2005). However, Dreyfus and Dreyfus label the middle category as “competent.” In order to avoid confusion with the terminology used in this study, “competent” was replaced by “average” as the shortened descriptor for the middle category.

After the end of the CTW, the three instructors met to review their individual scores and assigned an overall rating for each student to indicate their competence with presentations. It might be assumed that the overall competence scores were determined simply by averaging the four ratings from the introduction, impromptu, 5-minute visualization, and team presentations. However, the weight of each presentation was not equal. For example, the 60-second introduction was not as involved or difficult as the 10-minute team presentation. Students who struggled with impromptu presentations may have done very well on the 5-minute presentation when given the opportunity to plan and practice. Instead of trying to determine appropriate weights for the competence scores for each of the individual exercises, the final team presentation was given the most weight. All three instructors saw every student during the team presentations. So, while the team presentation was the most important, the students’ overall performance during the CTW was considered by the three instructors. The three instructors discussed the instructional support that each student required to improve their presentation skills during the rest of the program. Then, the three instructors assigned a rating to that student. If there was any disagreement among the three instructors, they discussed the evidence and came to an agreement on the rating. The use of three instructors to assign the competence rating made the competence measure more reliable. Magin and Helmore (2001) warn against relying on just one instructor assigning a rating. Again, it is important to note that these ratings in no way affected the students’ grade, nor should they be considered a grade. Rather, the ratings were simply a way
to categorize students based on how the students’ presentation skills needed to be supported during the rest of the program.

**Collecting Demographic Data**

Two pieces of demographic data were collected from the existing enrolled student database: sex and age. The instructor has access to the enrolled student database, which contains extensive demographic information. For this study, only sex and age are considered. As for sex, the binary male/female was used, which was collected at the time of application by the admissions committee. This did not take into account students who identify as non-binary. However, the enrolled student database does not collect that information at the time. As for age, the data was changed from continuous to categorical by separating the students into two categories: younger and older. The bins of younger and older were determined by the median of the age range. Any students younger than the median were labeled as younger. Any students equal to or older the median were labeled as older.

**Cleaning the Data**

All the data sets were handled with extreme care to protect the sensitive student information and maintain confidentiality at all points. Even though the data does not include any students’ grades, the researcher is committed to the ethical responsibility of protecting student data. Each student in the data set was assigned a random identification number. If any student was missing any of the confidence ratings or competence ratings, they were removed from the data set. Data was stored on a password protected computer with the password protected master sheet file being the only connection between the names of the students and their random identification number. That master sheet was stored in a separate file from the data being analyzed. After the completion of the study, the master sheet will be deleted.
Data Analysis Steps

After the data was cleaned, the analysis was conducted using Excel and the open-source programming language R. Table 3.4 provides an overview of the analysis that was used for each of the five research questions.

Table 3.4

Variables and Analysis Methods for Research Questions

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Type of Variables</th>
<th>Analysis Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Likert scale confidence rating</td>
<td>Descriptive (Median, Mode, Percents)</td>
</tr>
<tr>
<td>2</td>
<td>Likert scale competence rating</td>
<td>Descriptive (Median, Mode, Percents)</td>
</tr>
<tr>
<td>3</td>
<td>Likert scale confidence rating &amp; Likert scale competence rating</td>
<td>Descriptive (Percents)</td>
</tr>
<tr>
<td>4</td>
<td>Likert scale confidence rating and Likert scale competence rating</td>
<td>Descriptive Spearman’s Correlation</td>
</tr>
<tr>
<td>5</td>
<td>Sex and Age (Independent Variables) Confidence Rating (Dependent Variable)</td>
<td>Inferential Regression</td>
</tr>
</tbody>
</table>

Table 3.4 shows the types of variables and the analysis methods for each of the five research questions. Likert scale data from the students’ confidence ratings and the instructors’ competence ratings were treated as continuous and were used for the first four research questions. The analysis for research questions one and two was descriptive statistics of median, mode, and percents. Research question three used percents to analyze the data. For research question four, Spearman’s correlation was used to determine relationships between confidence and competence ratings. Finally, for research question five, multiple linear regression was used.
to determine if the independent or predictor variables of sex and age influenced the criterion or response variable of confidence rating. Interactions between sex and age were also analyzed. In addition, class (either class of 2019 or class of 2020) was entered as part of the multiple linear regression to correct for any influence of the different classes.

**Research Question 1**

Research question one asks: What are the students’ self-reported confidence ratings as measured four times within five months of their presentation skills? In order to answer this question, descriptive statistics were used to identify how many students rated their confidence levels in each category of one to five. The median and mode were determined in order to provide a detailed picture of students’ self-reported confidence with presentation skills. Median and mode were selected because the data is ordinal (Sproull, 1995). The median identifies the middle point of the data of the students’ ratings of their confidence and the mode shows the ratings that occurred the most. Data for each of the four points of collection (prior to the start of the program, at the start of the program, at the start of the CTW, and at the conclusion of the CTW) analyzed and compared. The purpose of looking at all four instances was to see if there were changes over time. The change over time was reported using percentages. The analysis included the percentage of students whose confidence rating stayed the same, the percentage that increased, and the percentage that decreased.

**Research Question 2**

Research question two asks: What are the instructors’ competence ratings of students’ presentation skills? As with research question one, descriptive statistics were used to identify the instructors’ competence ratings as the percentage of students in each category of one to five. The
median and mode was determined in order to provide a detailed picture of the instructors’ competence ratings.

**Research Question 3**

Research question three asks: How do students’ self-reported confidence ratings as measured four times within five months compare (equal to, overestimated, or underestimated) to instructors’ competence ratings? The self-reported student confidence ratings and the instructors’ competence ratings were compared to determine the percentage that are the same and the percentage that are different. When looking at the students’ ratings that are different from the instructors’ ratings, the goal was to determine what percentage of students overestimate and what percentage underestimate their presentation skills.

**Research Question 4**

Research question four asks: Is there a statistically significant relationship between students’ self-reported confidence with presentation skills and instructors’ rating of their presentation competence? To answer this question, Spearman’s correlation was used. The reason to use Spearman and not Pearson is because Spearman is used when evaluating relationships between ordinal variables (Lund & Lund, 2015). Spearman’s correlation provides the strength and direction of the association between variables (Gravetter & Wallnau, 2008). The researcher looked at each of the four instances that confidence ratings were collected and determined if there is a relationship with the instructors’ competence ratings.

**Research Question 5**

Research question five asks: Do sex and age significantly influence students’ self-assessed presentation confidence ratings? To begin, frequencies of the demographic information
were determined and reported. Sex was treated as binary (male or female) because of the way that it was collected at the time of the students’ applications to the program. Age was also treated as binary (younger or older). The median age was determined and then used to define the threshold between younger or older. Any students younger than the median were labeled as younger. Any students older or equal to the median were labeled as older.

Regression was used to determine if sex and age significantly influence students’ self-assessed presentation confidence ratings. Using multiple linear regression allowed an examination of how sex and age influence the students’ confidence ratings. In addition to the predictor variables of sex and age, the variable of class was added to control for interactions because two groups of students (the class of 2019 and the class of 2020) were included in the study population.

**Ethical Considerations**

The researcher is aware of the potential ethical issues associated with this study. First, the researcher was directly involved with the assessment of students’ competence ratings. To reduce concerns about bias or influence, the competence rating was determined through consensus with the researcher and two additional instructors. The competence ratings were not associated with students’ grades; however, careful handling of the data was required to maintain ethical SoTL practices. In addition, by disclosing that this study was inspired by SoTL methodology, the researcher was transparent in her involvement with the data. A second concern is that by studying her own students, the researcher was essentially providing some identifying information about the subjects in the study. However, by using two classes of confidence data, the size of the study population helped to keep students’ identities confidential. At no point in the study were
the two classes of students separated when presenting the analysis. Keeping the data combined for the two classes makes it more difficult to speculate on any student identities.

**Summary**

This chapter provided details about the methodology of the study. With a focus on SOTL methodology, the design, questions, and variables used in the study were explained. The population of PSM students and their non-graded reflection exercises that provide the confidence ratings and the instructors’ ratings of competence were detailed. An overview of some measurement instruments showed why the students’ confidence ratings and the instructors’ competence ratings were the appropriate measures for this study. The steps for cleaning and analyzing the data were presented along with support for the particular choices of methods. Chapter three ended with a discussion of the limitations and ethical considerations for the study.
CHAPTER 4: FINDINGS

“The job of gaining self-knowledge is very, very hard” (Dunning, 2005).

Chapter four presents the findings about professional science master’s (PSM) degree students’ self-reported confidence ratings and instructors’ competence ratings for presentation skills. The chapter is divided into seven sections: an overview of the study (including the data collection, demographics, and three key findings), one section for each of the five research questions, and a final section that summarizes the findings.

Overview

In this overview section, a review of the research questions for the study, the data collection techniques, and student demographics are listed. In addition, three key findings are briefly discussed.

Research Questions

The questions that drove this study were:

- Research Question 1: What are the students’ self-reported confidence ratings as measured four times within five months of their presentation skills?
- Research Question 2: What are the instructors’ competence ratings of students’ presentation skills?
- Research Question 3: How do students’ self-reported confidence ratings as measured four times within five months compare (equal to, overestimated, or underestimated) to instructors’ competence ratings?
• Research Question 4: Is there a statistically significant relationship between students’ self-reported confidence with presentation skills and instructors’ rating of their presentation competence?

• Research Question 5: Do sex and age significantly influence students’ self-assessed presentation confidence ratings?

Data Collection

All data for this study was collected from the PSM class of 2019 and the class of 2020. Data was collected between March 15-August 10, 2018 for the class of 2019 and data was collected between March 15-August 9, 2019 for the class of 2020. The data that was collected included students’ demographic data (sex and age), students’ confidence ratings of their presentation skills, and instructors’ competence ratings of students’ presentation skills. Both the students’ ratings and the instructors’ ratings used in the study are on a scale of one to five. Demographic data was collected in March-May of 2018 and 2019, which is at the point of acceptance to the PSM program. Students’ self-reported confidence ratings were collected four times. The first point of collection was during the initial assessment that was administered prior to the start of the PSM program in March-May of 2018 and 2019. The second point of collection was at the start of the first communication class for the PSM program in June of 2018 and 2019. The third and fourth point of collection happened during the Communication Training Workshop (CTW) at the very end of July and beginning of August in 2018 and 2019. Point three collection happened at the start of the CTW and point four collection happened four days later at the end of the CTW.

The students’ confidence ratings were collected from ungraded reflection exercises as part of the regular curriculum for the PSM students. Students rated their confidence with
presentation skills on a Likert scale of one to five using a Google form. The competence ratings by the instructors were determined by consensus between three instructors after observing the students present four times during the CTW in August of 2018 and 2019. The instructors also used a five-point Likert scale for the competence ratings. The instructors’ competence ratings were not grades, but rather the ratings were categories that indicated what kind of additional support was needed for the students. In order to maintain confidentiality of student information, student names were removed and replaced with random identification numbers.

**Demographics**

The sampling method used was census because all the students from the class of 2019 and the class of 2020 were included in the study. The total number of students for the two classes was 230. However, 15 students were removed from the study because of missing confidence ratings. These missing ratings were the result of computer problems (including technical problems with Google forms, forgetting a laptop, and not being able to enter a confidence rating during the reflection exercise at the start of class), missing class (because of illness), being late to class and missing the reflection exercise, or simply not completing the reflection assignment. As a result, 215 students’ responses were analyzed.

The 215 students examined in this study consist of 123 men (57.21%) and 92 (42.79%) women. The age of students ranged from 22 years old to 58 years old. The mean age was 25 years old, the mode was 22 years old, and the median was 24 years old. For the study, the median was used to divide students into two categories: younger students or older students. Students aged 23 and younger were labeled as younger. Any students aged 24 years or older were labeled as older. Using this method to label the students resulted in 96 (44.65%) younger
students and 119 (55.35%) older students. In general, the younger students were just out of their undergraduate studies and had little to no full time work experience.

**Three Key Findings**

Before presenting the findings for each of the five research questions, three key findings stand out from this study. The first key finding is that this study affirms the work of Kruger and Dunning (1999). The findings indicate that the results of comparing PSM students’ self-reported confidence ratings and the instructors’ competence ratings are similar to the Dunning and Kruger Effect (DKE). The DKE shows that those scoring low in competence overestimate themselves and those scoring high in competence underestimate themselves. This pattern was present in all four points of measurement of confidence in the study and is discussed in the findings for Research Question 3 section. The second key finding is that instructors’ competence ratings have only a moderate correlation with students’ confidence ratings, which will be more fully addressed in the findings for Research Question 3 and Research Question 4 sections. The third key finding is that sex and age did not significantly influence students’ self-reported confidence scores. This topic will be more fully addressed in the findings for Research Question 5 section. The following five sections detail the specific findings for each of the five research questions.

**Research Question 1**

Research question one asks: what are the students’ self-reported confidence ratings as measured four times within five months of their presentation skills? To answer this question, median, mode, and percents were used to analyze the confidence ratings from each of the four points of collection. Although the mean is the typical measure of central tendency, median was chosen for the ordinal variables in order to show the middle point of the data of the students’ ratings of their confidence with presentation skills even though there were no extreme ratings.
The mode was chosen to show the ratings that occurred the most. In order to establish a general understanding of how students rate their confidence with presentation skills, Table 4.1 shows the median and mode for all four points of collection.

Table 4.1

*Median and Mode for All Four Points of Collection*

<table>
<thead>
<tr>
<th>Point</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Note that the median and mode are the same at each of the four points of collection of the students’ confidence ratings of their presentation skills. Points one and four show higher median and mode of four. Points two and three show median and mode of three. Although median and mode provides a good overview of students’ self-reported confidence, a discussion of the percentages of the ratings for each point of collection give a much more detailed picture.

**Point 1 Percentages Prior to PSM Program**

Before starting their PSM program, students completed an assessment that included the question about confidence with presentation skills. For this point of collection of confidence ratings, students have not met each other. The students have had very limited interaction with faculty and staff during their interviews, which means that they do not have a clear picture of the expectations of the faculty and staff at that point. In addition, the requirements of the program
were not fully clear to the students. Figure 4.1 displays the breakdown of confidence ratings for point one in a pie chart.

![Figure 4.1: Point 1 (prior to PSM) confidence rating percentages.](image)

At point one, prior to starting their PSM program, most students (73%) rated their confidence as a three or four. The students rating themselves as a three was 35.3% and students rating themselves as a four was 37.7%. It is interesting to note that 12.6% of students rated their confidence as a five because this is the highest percentage of a rating of five from all four points of collection. At no other time in the collection of confidence ratings did so many students indicate a rating of five. On the other end of the continuum, 13% rated their confidence as a two and only 1.4% rated their confidence as a one.

**Point 2 Percentages at Start of PSM Program**

The second collection of confidence ratings occurred at the start of the PSM program. At point two, students had met their fellow classmates, the staff, and faculty of the PSM. Figure 4.2 shows the breakdown of confidence ratings for point two.
Figure 4.2: Point 2 (start of PSM) confidence rating percentages.

The number of students rating their confidence as a three increased to 48.4% (up from 35.3% in point one). At point two, 29.8% rated themselves as a four, which means that 78.2% of the students rated their confidence as a three or four. There is a slight increase in the number of students rating their confidence as a one (2.8%) and a slight decrease in the number of students rating their confidence as a five (5.6%). At point two, 13.5% of the students rated their confidence as a two, which is similar to the 13% who rated their confidence a two at point one.

**Point 3 Percentages at Start of CTW**

Point three collection happened at the start of the Communication Training Workshop (CTW). Figure 4.3 shows the breakdown of confidence ratings for point three.
A notable change for point three is that fewer students (2.8%) rated their confidence as a five. In addition, the most students (56.7%) rated their confidence as a three. Out of the four points of collection of confidence ratings, the number of students rating a three for point three was the highest. At point three, 28.8% of students rated themselves as a four. The number of students rating as a one dropped to just 0.9% and those rating a two dropped to 10.7%.

**Point 4 Percentages at End of CTW**

Point four collection occurred at the end of the CTW, which is just three days after the collection of point three ratings. This point of collection is not spaced out like the other points of collection (March through May for point one, June for point two, July/August for point three). Figure 4.4 shows the breakdown of confidence ratings for point four.
At the point four collection, there is an increase in the students rating themselves as a four in terms of presentation confidence. After participating in the CTW, 48.4% of the students rated their confidence as a four, this is higher than at point one when 37.7% of the students rated their confidence as a four. Although the percentage of students selecting a rating of one was low in point one (1.4%), point two (2.8%), and point three (0.9%), not a single student rated their confidence as a one at point four. In point three, just three days prior to point four collection, only 2.8% of students rated their confidence as a five. At point four, 9.3% of students rated their confidence as a five. It is relevant to note that at point one, 12.6% of students rated their confidence as a five, which is the highest percentage of a rating of five for all four points.

**Summary of All Four Points**

The four points of collection show that overall, most students rated their confidence as a three or four. In Figure 4.5, all four points of confidence collection are shown next to each other to make comparisons easier.
Figure 4.5 Percentages for all four points.

The yellow and green sections of the four pie charts show that the ratings of three and four respectively are the most common across all four points of collection. A rating of one for confidence was the least likely rating. Not a single student selected a rating of one at the fourth point of collection.

In order to more easily compare the findings from the four points of collection, Table 4.2 shows the median, mode, and percents for all four points of collection.
Table 4.2

Median, Mode, and Percents for All Four Points of Collection

<table>
<thead>
<tr>
<th></th>
<th>Point 1 Prior to PSM</th>
<th>Point 2 Start of PSM</th>
<th>Point 3 Start of CTW</th>
<th>Point 4 End of CTW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Mode</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Rating of 1 in %</td>
<td>1.4</td>
<td>2.8</td>
<td>0.9</td>
<td>0</td>
</tr>
<tr>
<td>Rating of 2 in %</td>
<td>13.0</td>
<td>13.5</td>
<td>10.7</td>
<td>5.1</td>
</tr>
<tr>
<td>Rating of 3 in %</td>
<td>35.3</td>
<td>48.4</td>
<td>56.7</td>
<td>37.2</td>
</tr>
<tr>
<td>Rating of 4 in %</td>
<td>37.7</td>
<td>29.8</td>
<td>28.8</td>
<td>48.4</td>
</tr>
<tr>
<td>Rating of 5 in %</td>
<td>12.6</td>
<td>5.6</td>
<td>2.8</td>
<td>9.3</td>
</tr>
</tbody>
</table>

Table 4.2 shows that points one and four have the same median and mode. Points two and three also have the same median and mode. However, the percentages for each rating show the differences between each point of confidence collection. The percentage ratings show changes across time. These changes are discussed in the sections below.

Changes Over Time

In addition to the median, mode, and overall percentages of students’ confidence ratings, a discussion of the changes in time between point one to point four appears below. The findings presented below include the percentage of students whose confidence rating stayed the same, the percentage that increased, and the percentage that decreased.
Confidence ratings stayed the same. A total of 48 students (22.33%) entered the same confidence rating for all four points of collection. Table 4.3 shows the breakdown of the students selecting the same confidence rating.

Table 4.3

Frequency of Confidence Ratings that Stayed the Same

<table>
<thead>
<tr>
<th>Frequency</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Older Women</td>
<td>11</td>
</tr>
<tr>
<td>Younger Women</td>
<td>11</td>
</tr>
<tr>
<td>Older Men</td>
<td>14</td>
</tr>
<tr>
<td>Younger Men</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 4.3 shows that of those 48 students 22 were women (11 older women and 11 younger women) and 26 men (14 older men and 12 younger men). None of the 48 students who entered the same rating for all four points selected a rating of one or two. Twenty-three students (10.7%) entered a rating of three for all four points of collection. Of those 23 students, 11 were men (five older and six younger) and 12 were women (six older and six younger). Twenty-one students (9.77%) entered a rating of four for all four points of collection. Of those 21 students, nine were women (five older women and four younger women) and 12 were men (six older men and six younger men). Four students (1.8%) entered a rating of five for all four points of collection. Of those four, two were women (one older woman and one younger woman) and two were older men.

Although less than a quarter of the students entered the same rating for all four points of collection, some students did select the same rating between points one and two, points two and three, points three and four, and points one and four. Table 4.4 shows two important kinds of information. First, Table 4.4 shows the percentage of confidence ratings that stayed the same
between the different points of collection. Second, Table 4.4 shows the frequencies for older and younger men and women.

Table 4.4

*Confidence Ratings that Stayed the Same in Percents and Frequency*

<table>
<thead>
<tr>
<th>Stayed the Same</th>
<th>Point 1 to Point 2</th>
<th>Point 2 to Point 3</th>
<th>Point 3 to Point 4</th>
<th>Point 1 to Point 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older Women</td>
<td>23</td>
<td>28</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Younger Women</td>
<td>26</td>
<td>28</td>
<td>20</td>
<td>27</td>
</tr>
<tr>
<td>Older Men</td>
<td>37</td>
<td>46</td>
<td>37</td>
<td>26</td>
</tr>
<tr>
<td>Younger Men</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>112</td>
<td>129</td>
<td>106</td>
<td>96</td>
</tr>
</tbody>
</table>

Table 4.4 shows that from point two to point three, more students (60%) entered the same rating than at any other interval. Overall, more older men entered the same rating followed by younger men, younger women, and then older women.

One hundred twelve students (52.09%) rated their confidence as the same for point one to point two. Of those 112 students, 49 were women (23 older women and 26 younger women) and 63 were men (37 older men and 26 younger men). One hundred and twenty-nine students (60%) rated their confidence as the same for point two to point three. Of those students, 56 were women (28 older women and 28 younger women) and 73 were men (46 older men and 27 younger men). One hundred and six students (49.3%) rated their confidence as the same for point three and point four. Of those students, 41 were women (21 older women and 20 younger women) and 65 were men (37 older men and 28 younger men). Lastly, 96 students (44.65%) selected the same confidence rating for point one (prior to the start of the program) and for point four (at the end of the CTW and the last point of collection for confidence for this study). Of those students, 47
were women (20 older women and 27 younger women) and 49 were men (26 older men and 23 younger men).

**Confidence ratings increased.** Most students did not select the same rating for confidence for each of the four points. Many students increased their ratings. Table 4.5 shows two important kinds of information. First, Table 4.5 shows the percentage of confidence ratings that increased between the different points of collection. Second, Table 4.5 shows the frequencies for older and younger men and women.

Table 4.5

**Confidence Ratings that Increased in Percents and Frequency**

<table>
<thead>
<tr>
<th></th>
<th>Point 1 to Point 2</th>
<th>Point 2 to Point 3</th>
<th>Point 3 to Point 4</th>
<th>Point 1 to Point 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increased</strong></td>
<td>13.49%</td>
<td>19.06%</td>
<td>44.19%</td>
<td>33.95%</td>
</tr>
<tr>
<td>Older Women</td>
<td>5</td>
<td>9</td>
<td>23</td>
<td>16</td>
</tr>
<tr>
<td>Younger Women</td>
<td>5</td>
<td>9</td>
<td>22</td>
<td>13</td>
</tr>
<tr>
<td>Older Men</td>
<td>12</td>
<td>14</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Younger Men</td>
<td>7</td>
<td>9</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>29</td>
<td>41</td>
<td>95</td>
<td>73</td>
</tr>
</tbody>
</table>

Table 4.5 shows that from point three to point four, more students (44.19%) increased their rating. More older men increased their ratings followed by older women, younger women, and then younger men.

From point one to point two, 29 students (13.49%) increased their confidence rating. Of those 29 students, 10 were women (5 older women and 5 younger women) and 19 were men (12 older men and 7 younger men). From point two to point three, 41 students (19.06%) increased their confidence rating. Of those 41 students, 18 were women (9 older women and 9 younger women) and 23 men (14 older men and 9 younger men). Ninety-five students (44.19%) increased...
their rating between point three and point four. Of those 95 students, 45 were women (23 older women and 22 younger women) and 50 were men (30 older men and 20 younger men). Lastly, 73 students (33.95%) increased their rating between point one collected at the assessment and point four collected at the end of the CTW. Of those students 29 were women (16 older women and 13 younger women) and 44 were men (30 older men and 14 younger men).

Confidence ratings decreased. Some students decreased their confidence ratings between points one, two, three, and four. Table 4.6 shows two important kinds of information. First, Table 4.6 shows the percentage of confidence ratings that decreased between the different points of collection. Second, Table 4.6 shows the frequencies for older and younger men and women.

Table 4.6

Confidence Ratings that Decreased in Percents and Frequency

<table>
<thead>
<tr>
<th></th>
<th>Point 1 to Point 2</th>
<th>Point 2 to Point 3</th>
<th>Point 3 to Point 4</th>
<th>Point 1 to Point 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decreased</strong></td>
<td>34.41%</td>
<td>20.93%</td>
<td>6.51%</td>
<td>21.39%</td>
</tr>
<tr>
<td>Older Women</td>
<td>19</td>
<td>10</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Younger Women</td>
<td>14</td>
<td>8</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Older Men</td>
<td>23</td>
<td>12</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Younger Men</td>
<td>18</td>
<td>15</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>74</td>
<td>45</td>
<td>14</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 4.6 shows that from point one to point two that more students (34.41%) decreased their rating. More older men decreased their ratings followed by older women, younger men, and younger women.

Between point one and point two, 74 students (34.41%) decreased their confidence rating. Of those 74 students, 33 were women (19 older women and 14 younger women) and 41
were men (23 older men and 18 younger men). Between point two and point three, 45 students (20.93%) decreased their confidence ratings. Of those 45 students, 18 were women (10 older women and 8 younger women) and 27 were men (12 older men and 15 younger men). Fourteen students (6.51%) decreased their confidence rating between points three and four. Six of those students were women (three older women and three younger women) and eight were men (five older men and three younger men). Finally, 46 students (21.39%) decreased their rating between point one and point four. Sixteen of those students rating themselves lower at point four than at point one were women (eleven older and five younger). Thirty men (16 older and 14 younger) decreased their confidence rating from point one to point four.

Table 4.7 shows all the data for the change over time including ratings that stayed the same, increased, and decreased in percentages and the frequencies of older and younger women and men.
Table 4.7

Confidence Ratings that Stayed the Same, Increased, or Decreased in Percents and Frequency

<table>
<thead>
<tr>
<th></th>
<th>Point 1 to Point 2</th>
<th>Point 2 to Point 3</th>
<th>Point 3 to Point 4</th>
<th>Point 1 to Point 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stayed the Same</strong></td>
<td>52.90%</td>
<td>60%</td>
<td>49.3%</td>
<td>44.65%</td>
</tr>
<tr>
<td>Older Women</td>
<td>23</td>
<td>28</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Younger Women</td>
<td>26</td>
<td>28</td>
<td>20</td>
<td>27</td>
</tr>
<tr>
<td>Older Men</td>
<td>37</td>
<td>46</td>
<td>37</td>
<td>26</td>
</tr>
<tr>
<td>Younger Men</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>112</td>
<td>129</td>
<td>106</td>
<td>96</td>
</tr>
<tr>
<td><strong>Increased</strong></td>
<td>13.49%</td>
<td>19.06%</td>
<td>44.19%</td>
<td>33.95%</td>
</tr>
<tr>
<td>Older Women</td>
<td>5</td>
<td>9</td>
<td>23</td>
<td>16</td>
</tr>
<tr>
<td>Younger Women</td>
<td>5</td>
<td>9</td>
<td>22</td>
<td>13</td>
</tr>
<tr>
<td>Older Men</td>
<td>12</td>
<td>14</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Younger Men</td>
<td>7</td>
<td>9</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>29</td>
<td>41</td>
<td>95</td>
<td>73</td>
</tr>
<tr>
<td><strong>Decreased</strong></td>
<td>34.41%</td>
<td>20.93%</td>
<td>6.51%</td>
<td>21.39%</td>
</tr>
<tr>
<td>Older Women</td>
<td>19</td>
<td>10</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Younger Women</td>
<td>14</td>
<td>8</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Older Men</td>
<td>23</td>
<td>12</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Younger Men</td>
<td>18</td>
<td>15</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Total Frequency</td>
<td>74</td>
<td>45</td>
<td>14</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 4.7 combines the three previous tables to make comparisons easier between points. The data about confidence ratings that stayed the same, increased, or decreased between points shows that between points one and two, it was more likely to have the same rating. However, a little more than a third of the students decreased their ratings between points one and two. Between points two and three, again it was likely for students to keep the same rating. Although almost half of the students kept the same rating between points three and four, the biggest change for increasing ratings occurred between point three and four.
Summary of Research Question 1

Research question one asked: what are the students’ self-reported confidence ratings as measured four times within five months of their presentation skills? In this section, the median, mode, and percents were presented for each of the four points of collection of confidence ratings. In addition, this section provided an examination of changes over time including ratings that stayed the same, increased, and decreased.

The median and mode were the same for point one and point four. The median and the mode were also the same for point two and point three. Looking at the students’ confidence ratings over time shows that almost a quarter of the students entered the same confidence rating at all four points of collection. The most students entered the same confidence rating for point two and point three. The most students entering increased confidence ratings happened between point three and point four. The most students entering decreased confidence ratings occurred between point one and point two. Overall, students rated their confidence with presentation skills as a three or four on a scale of one to five. Now that the findings for research question one about students’ confidence scores have been presented, the next section addresses the findings for research question two about instructors’ competence scores.

Research Question 2

Research question two asks: what are the instructors’ competence ratings of students’ presentation skills? To answer this question, median, mode, and percents were used to analyze the instructors’ competence ratings, much like the analysis of the students’ self-reported confidence ratings. The median and mode were chosen because the competence data is ordinal. Unlike the students’ confidence ratings that were collected four time, the instructors’ competence ratings were only collected once after the conclusion of the CTW. The instructors’ competence
ratings from one to five are assigned to students by a group of three instructors. Table 4.8 shows the median and mode for the instructor’s competence ratings.

Table 4.8

*Median and Mode for Competence Rating*

<table>
<thead>
<tr>
<th>Competence</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

As shown in Table 4.8, the competence ratings for all 215 students is a three for both the median and the mode. A more detailed picture of the competence ratings can be seen in Figure 4.6 that shows the percentages of the competence ratings.

Figure 4.6: Percentages of competence ratings.

Figure 4.6 shows that most of the students (45.1%) received a rating of three. About a quarter of the students received a rating of a two (25.1%) or a four (24.7%). On the extreme ends of the rating continuum, the remaining students received a rating of one (1.9%) or five (3.3%). When visualizing the same information using a line graph, it is obvious that the competence
scores form a bell-shaped distribution. Figure 4.7 shows the instructors’ competence scores for students’ presentations.

![Line graph of competence ratings](image)

Figure 4.7: Line graph of competence ratings.

While researchers question the merit of enforcing a normal curve on grades (Bailey & Steed, 2012; Brookhart et al., 2016), the instructors did not force students into these five categories. Rather, the findings show that this bell-shaped curve did occur without prior intention to stick to a bell-shaped curve when assigning ratings.

**Summary of Research Question 2**

Research question two asked: what are the instructors’ competence ratings of students’ presentation skills? To answer this question, median, mode, and percents were used. This section presented the findings for research question two, which is needed in order to discuss the findings for research question three that compares the students’ confidence ratings and the instructors’ competence ratings.
Research Question 3

Research question three asks: how do students’ self-reported confidence ratings as measured four times within five months compare (underestimated, equal to, or overestimated) to instructors’ competence ratings? The students’ confidence ratings and the instructors’ competence ratings were compared to determine the percentage that are the same and the percentage that are different. Specifically, when examining the students’ ratings that are different from the instructors’ ratings, the percentage of students overestimating and underestimating was determined. Then, the pattern of overestimating and underestimating was compared to the Dunning Kruger Effect (DKE).

First, in order to get a clear understanding of how the four points of student-rated confidence compared to the instructor-rated competence, Figure 4.8 shows the distribution of ratings for the students’ ratings of confidence at the four different points of collection as compared to the instructors’ competence ratings.
Figure 4.8: Distribution of percentages for confidence and competence ratings combined.

Although not a specific intention or goal of the three instructors, the competence ratings created a bell-shaped curve as shown in Figure 4.8. Most students received a competence rating of three with fewer students receiving a rating on the low end (ones and twos) and higher end (fours and fives). As Figure 4.8 shows, point two (light blue dotted line) and point three (dark blue dashed line) confidence ratings created a distribution that is close to a bell-shaped curve. Point one (light blue line) and point four (dark blue line) created a more left-skewed distribution with more higher ratings for confidence. Looking at the data in this way shows the overall pattern of the ratings. Table 4.9 presents the figures and percentages used to create Figure 4.8.
Table 4.9

*Confidence for All Four Points and Competence Ratings in Frequencies and Percentages*

<table>
<thead>
<tr>
<th>Rating</th>
<th>Point 1 Prior to PSM</th>
<th>Point 2 Start of PSM</th>
<th>Point 3 Start of CTW</th>
<th>Point 4 End of CTW</th>
<th>Competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(1.4%)</td>
<td>(2.79%)</td>
<td>(0.93%)</td>
<td>(0%)</td>
<td>(1.9%)</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>29</td>
<td>23</td>
<td>11</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>(13%)</td>
<td>(13.5%)</td>
<td>(10.7%)</td>
<td>(5.1%)</td>
<td>(25.1%)</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>104</td>
<td>122</td>
<td>80</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>(35.3%)</td>
<td>(48.4%)</td>
<td>(56.7%)</td>
<td>(37.2%)</td>
<td>(45.1%)</td>
</tr>
<tr>
<td>4</td>
<td>81</td>
<td>64</td>
<td>62</td>
<td>104</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>(37.7%)</td>
<td>(29.8%)</td>
<td>(28.8%)</td>
<td>(48.4%)</td>
<td>(24.7%)</td>
</tr>
<tr>
<td>5</td>
<td>27</td>
<td>12</td>
<td>6</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(12.6%)</td>
<td>(5.6%)</td>
<td>(2.79%)</td>
<td>(9.3%)</td>
<td>(3.3%)</td>
</tr>
</tbody>
</table>

Table 4.9 allows an examination of the both the number of students who selected a specific rating frequency and the corresponding percentage. It also shows the competence ratings. The biggest discrepancy between confidence and competence occurred at point four. One hundred and four students (48.4%) rated their confidence as a four as compared to the 53 students (24.7%) who received a competence rating of four. More specific details about how the individual confidence ratings compare to the competence ratings will be discussed in the sections below.

**Compare: Equal To, Overestimated, or Underestimated**

In this section, each of the four points of collection of confidence ratings are compared to the instructors’ competence ratings to determine how many students had the same rating, overestimated, or underestimated.
**Point 1.** Before students start their PSM program, they rated their confidence with presentation skills. Figure 4.9 shows the confidence ratings collected prior to the start of the PSM program in comparison to the instructors’ competence ratings.

![Pie chart](image)

Figure 4.9: Percentages comparing competence and confidence at point 1 (prior to PSM).

At point one, a little more than a third (35.3%) of the students rated their confidence as equal to instructor-rated competence. Most (47.4%) of the students’ ratings of their confidence were overestimated when compared to the instructors’ rating of competence. A total of 37 students (17.2%) rated their confidence lower than the instructor-rated competence. The pie chart in Figure 4.9 gives an overview of the students who were equal to, overestimated, or underestimated. However, Figure 4.9 does not show which students did the overestimating or underestimating. Table 4.10 displays this information in a way to make comparisons easier.
Table 4.10

Overestimation and Underestimation by Sex and Age for Point 1 (prior to PSM)

<table>
<thead>
<tr>
<th></th>
<th>Older Women</th>
<th>Younger Women</th>
<th>Older Men</th>
<th>Younger Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overestimated by 3 points</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Overestimated by 2 points</td>
<td>4</td>
<td>7</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Overestimated by 1 point</td>
<td>19</td>
<td>14</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>OVERESTIMATION TOTALS</strong></td>
<td><strong>23</strong></td>
<td><strong>21</strong></td>
<td><strong>31</strong></td>
<td><strong>27</strong></td>
</tr>
<tr>
<td>Underestimated by 3 points</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Underestimated by 2 points</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Underestimated by 1 point</td>
<td>9</td>
<td>8</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td><strong>UNDERESTIMATION TOTALS</strong></td>
<td><strong>9</strong></td>
<td><strong>9</strong></td>
<td><strong>11</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>

Seventy-three students overestimated by one point. Although this is important to note, the more important findings are about students who overestimated by two or more points. Of the 102 students who overestimated, 29 students overestimated by two or more during the pre-assessment collection of confidence ratings. Five students rated their confidence at a level of five when instructors rated their competence at a two, which resulted in an overestimation by three points. Of these five students, all were men and two of them were younger students and three were older students. Twenty-four students overestimated by two points. Of those 24 students, 11 were women. Seven of the women were younger and four were older. Of the 13 men who overestimated by two points, five were younger and eight were older. No student overestimated
by four points. On the other end of the rating scale, no students underestimated by three or more points. Three students underestimated by two points. Of those students who underestimated by two points, two were older men and one was a younger woman. Thirty-four students underestimated by one point.

**Point 2.** The second point of collection of confidence ratings happened at the start of the PSM program. Students had met each other and the faculty and staff. At this point, more details about the program and the expectations of the program were shared. Figure 4.10 shows the confidence ratings collected at the start of the PSM program in comparison to the instructors’ competence ratings.

![Point 2](image)

Figure 4.10: Percentages comparing competence and confidence at point 2 (start of PSM).

As shown in Figure 4.10, eighty-three students (38.6%) matched their confidence ratings with the instructors’ competence ratings. For point two, 38.6% of the students overestimated.
This is a slight decrease from point one. Forty-nine students (22.8%) underestimated. This is a slight increase from point one. Figure 4.10 does not show who is doing the overestimating and underestimating. Table 4.11 displays the students’ overestimation and underestimation by one, two, or three points in a way that makes it easier to compare.

Table 4.11

*Overestimation and Underestimation by Sex and Age for Point 2 (start of PSM)*

<table>
<thead>
<tr>
<th></th>
<th>Older Women</th>
<th>Younger Women</th>
<th>Older Men</th>
<th>Younger Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overestimated by 3 points</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Overestimated by 2 points</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Overestimated by 1 point</td>
<td>18</td>
<td>11</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td><strong>OVERESTIMATION TOTALS</strong></td>
<td><strong>18</strong></td>
<td><strong>15</strong></td>
<td><strong>28</strong></td>
<td><strong>22</strong></td>
</tr>
<tr>
<td>Underestimated by 3 points</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Underestimated by 2 points</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Underestimated by 1 point</td>
<td>8</td>
<td>9</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td><strong>UNDERESTIMATION TOTALS</strong></td>
<td><strong>11</strong></td>
<td><strong>10</strong></td>
<td><strong>15</strong></td>
<td><strong>13</strong></td>
</tr>
</tbody>
</table>

At point two, a total of 83 students overestimated. Of those, 70 students overestimated by one point. A total of 13 students overestimated by two or more points. Only one older man overestimated by three points. Twelve students overestimated by two points. Of those 12, eight were men with half being younger and half being older. The four women who overestimated by two points were all younger. Forty-nine students underestimated. Six students underestimated by
two points. Of those six, four were women (one was younger and the other three were older), and two were older men. No student underestimated by three or more points.

**Point 3.** The third point of collection of students’ confidence ratings happened at the start of the CTW. At this point, the students had been working together all summer, presented two times in teams, and had gotten specific verbal and written feedback about their presentation competence. Figure 4.11 shows the students’ confidence ratings in comparison to the instructors’ competence ratings.

![Pie chart showing Point 3](image)

Figure 4.11: Percentages comparing competence and confidence at point 3 (start of CTW).

Ninety-nine students (46%) rated their confidence the same as the instructors’ ratings of competence. Seventy-seven students (35.8%) rated their confidence higher than the instructors’ rating of competence, which is six fewer students than overestimated at point two. Fewer students underestimated at point three than they did at point two. At point three, 39 students
(18.1%) underestimated. Table 4.12 displays the students’ overestimation and underestimation by one, two, or three points in a way that makes it easier to compare.

Table 4.12

*Overestimation and Underestimation by Sex and Age for Point 3 (start of CTW)*

<table>
<thead>
<tr>
<th></th>
<th>Older Women</th>
<th>Younger Women</th>
<th>Older Men</th>
<th>Younger Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overestimated by 3 points</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Overestimated by 2 points</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Overestimated by 1 point</td>
<td>15</td>
<td>12</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td><strong>OVERESTIMATION TOTALS</strong></td>
<td><strong>15</strong></td>
<td><strong>15</strong></td>
<td><strong>28</strong></td>
<td><strong>19</strong></td>
</tr>
<tr>
<td>Underestimated by 3 points</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Underestimated by 2 points</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Underestimated by 1 point</td>
<td>9</td>
<td>7</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td><strong>UNDERESTIMATION TOTALS</strong></td>
<td><strong>10</strong></td>
<td><strong>7</strong></td>
<td><strong>12</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

At point three, seventy students overestimated by one point. However, only seven students overestimated by two points. Of those seven, four were men (three older and one younger) and three were younger women. No students overestimated by three points. No students underestimated by three points. Only three students underestimated by two points. One older and one younger man underestimated, and one older woman underestimated. Thirty-six students underestimated by one point.
**Point 4.** The fourth point of collection of students’ confidence ratings happened at the end of the CTW. Point four occurred just three days after the point three collection. Although the space between the points of collection are not consistent, the collection at the start and the ending of the CTW was intentional. Figure 4.12 shows the students’ confidence ratings in comparison to the instructors’ competence ratings.

![Pie Chart](https://via.placeholder.com/350)

**Figure 4.12:** Percentages comparing competence and confidence at point 4 (end of CTW).

At point four, 63 students’ confidence ratings were equal to the instructors’ competence ratings. A total of 123 students (57.2%) overestimated. Of the four collections of confidence, this is the highest overestimation. Also, at point four, 29 students (13.5%) underestimated. This is the lowest number of students underestimating across the four collection points.

Table 4.13 displays the students’ overestimation and underestimation by one, two, or three points in a way that makes it easier to compare.
Table 4.13

*Overestimation and Underestimation by Sex and Age for Point 4 (end of CTW)*

<table>
<thead>
<tr>
<th>Overestimation by 3 points</th>
<th>Older Women</th>
<th>Younger Women</th>
<th>Older Men</th>
<th>Younger Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overestimated by 2 points</td>
<td>4</td>
<td>7</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Overestimated by 1 point</td>
<td>21</td>
<td>16</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td><strong>OVERESTIMATION TOTALS</strong></td>
<td><strong>26</strong></td>
<td><strong>25</strong></td>
<td><strong>43</strong></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Underestimated by 3 points</th>
<th>Older Women</th>
<th>Younger Women</th>
<th>Older Men</th>
<th>Younger Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underestimated by 2 points</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Underestimated by 1 point</td>
<td>5</td>
<td>5</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td><strong>UNDERESTIMATION TOTALS</strong></td>
<td><strong>6</strong></td>
<td><strong>5</strong></td>
<td><strong>11</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

For confidence collection point four, 91 students overestimated one point and 32 students overestimated by two or more points. Three women (one older and two younger) and two men (one older and one younger) overestimated by three points. Twenty-seven students overestimated by two points. Of those 27 students, 11 were women (7 younger and 4 older) and 16 were men (5 younger and 11 older). For point four, 26 students underestimated by one point. Lastly, three underestimated themselves by two points: one older woman and two younger men.

**Summary of All Four Points**

After examining each of the four points in order to identify the percentage of students whose confidence rating was equal to, overestimated, or underestimated as compared to the
instructors’ competence rating, this section presents all four points together. Figure 4.13 shows all four pie charts together to allow an easy comparison.

![Pie charts for points 1 to 4](image)

Figure 4.13: Equal to, overestimated, or underestimated for all four points of collection.

Those students with equal ratings for confidence and competence showed a trend in increasing from point one to point two to point three. However, at point four, fewer students rated their confidence as the same as the competence rating. The students’ ratings that were overestimated compared to the instructors’ competence ratings started off at just below half of the population. Point two and point three were similar in overestimation rates. However, point four showed an increase in overestimation with 57.2% of students overestimating. Lastly, the trend for
underestimation shows a fluctuation from 17.2% for point one to 22.8% for point two to 18.1% for point 3 to 13.5% for point four. The lowest rate of underestimation occurred in point four at the end of the CTW. Figure 4.14 is a line graph that highlights the changes from point one to point four in equal estimation, overestimation, and underestimation.

Figure 4.14: Line graph of the frequencies of equal, overestimation, and underestimation.

Figure 4.14 shows the frequency of equal estimation rose from point one to point two and topped out at point three before dropping to its lowest at point four. Overestimation dropped at point two and again at point three before rising at point four. The highest underestimation frequency occurred at point two. The tables below show the breakdown of sex and age for overestimation and underestimation. Table 4.14 shows the findings of overestimation of the four points combined together.
Table 4.14

Combined Overestimation by Sex and Age for All Four Points of Collection

<table>
<thead>
<tr>
<th></th>
<th>Overestimated by 3 points</th>
<th>Overestimated by 2 points</th>
<th>Overestimated by 1 point</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older Women</td>
<td>1</td>
<td>8</td>
<td>73</td>
<td>82</td>
</tr>
<tr>
<td>Younger Women</td>
<td>2</td>
<td>21</td>
<td>53</td>
<td>76</td>
</tr>
<tr>
<td>Older Men</td>
<td>5</td>
<td>26</td>
<td>99</td>
<td>130</td>
</tr>
<tr>
<td>Younger Men</td>
<td>3</td>
<td>15</td>
<td>79</td>
<td>97</td>
</tr>
</tbody>
</table>

Across all four points of collection of confidence ratings, more older men overestimated than younger men. Men overestimated more frequently than women. More older women overestimated than younger women.

Students underestimated themselves across all four points of collection. Table 4.15 shows the underestimation for all four points combined together.

Table 4.15

Underestimation by Sex and Age for All Four Points of Collection

<table>
<thead>
<tr>
<th></th>
<th>Underestimated by 1 point</th>
<th>Underestimated by 2 points</th>
<th>Underestimated by 3 points</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older Women</td>
<td>31</td>
<td>5</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Younger Women</td>
<td>29</td>
<td>2</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>Older Men</td>
<td>44</td>
<td>5</td>
<td>0</td>
<td>49</td>
</tr>
<tr>
<td>Younger Men</td>
<td>35</td>
<td>3</td>
<td>0</td>
<td>38</td>
</tr>
</tbody>
</table>

Table 4.15 shows that 15 students underestimated by two points. Eight men (5.33%) underestimated their rating and seven women (46.66%) underestimated their rating. No students
underestimated by three or more points. More older men underestimated compared to younger men. Older women underestimated more frequently than younger women.

In order to examine the overestimation and the underestimation further, Table 4.16 shows both the overestimation and underestimation by sex and age for all four points of collection of confidence ratings as compared to the competence ratings.

Table 4.16

Overestimation and Underestimation by Sex and Age for All Four Points of Collection

<table>
<thead>
<tr>
<th></th>
<th>Overestimated by 3 points</th>
<th>Overestimated by 2 points</th>
<th>Overestimated Totals</th>
<th>Underestimated by 2 points</th>
<th>Underestimated Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older Women</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Younger Women</td>
<td>2</td>
<td>21</td>
<td>23</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Older Men</td>
<td>5</td>
<td>26</td>
<td>31</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Younger Men</td>
<td>3</td>
<td>15</td>
<td>18</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Note that in Table 4.16 that there is no column for “Underestimated by 3 points” because no student underestimated by three points. In addition, the overestimation and underestimation by one point is not included. This table shows that older men overestimate by more than one point more often than younger women, older women, or younger men. More younger women overestimated as compared to younger men. Older men and women are tied in terms of underestimating.

The following four figures show the comparison of each of the four points of confidence ratings and the competence ratings. By showing this information in a set of bar charts, it is easy
to see the overestimation and underestimation as well as the changes over time. Figure 4.15 shows the number of students at point one who selected each of the confidence ratings and compares them to the competence ratings.

![Point 1 and Competence bar chart](image)

Figure 4.15: Point 1 (prior to PSM) and competence bar chart.

Figure 4.15 shows that at point one the competence rating of three is the most common while confidence rating of four is most common. In this format, the overestimation of those selecting the rating five for confidence is apparent. The confidence and competence ratings for the category of one are very similar. Despite the number of students receiving competence ratings of two and four being similar, the number of students selecting those confidence ratings are quite different.

Figure 4.16 shows the number of students at point two who selected each of the confidence ratings and compares them to the competence ratings.
Figure 4.16: Point 2 (start of PSM) and competence bar chart.

Figure 4.16 shows that at point two the most students are rated as a three in competence just like for point one. A change from point one is that at point two, more students rated their confidence as a three instead of a four. In this figure, the overestimation of those selecting the rating of five is still apparent, but it is not as large of a difference as it was in point one. The number of students rated as a two in competence remains higher than the number of students selecting two for confidence.

Figure 4.17 shows the number of students at point three who selected each of the confidence ratings and compares them to the competence ratings.
Figure 4.17: Point 3 (start of CTW) and competence bar chart.

Figure 4.17 shows that at point three the number of students rated as a three for competence remains the highest. More students rated their confidence as a three, which is similar to point two. The number of students rating their confidence as a one is quite similar to the number of students rated as a one for competence. The similar situation occurs for the number of students rating their confidence as a five and the number of students rated as a five for competence.

Figure 4.18 shows the number of students at point four who selected each of the confidence ratings and compares them to the competence ratings.
Figure 4.18: Point 4 (end of CTW) and competence bar chart.

Figure 4.18 shows that at point four that most students are rated as a three for competence. In terms of confidence, more students rated their confidence as a four, which is a change from points two and three. No student selected the category one rating for confidence, even though one was used for competence. For the rating category of five, the number of students rating their confidence as a five is almost as high as it was at the point one collection.

Figure 4.19 combines the last four figures together in order to compare the confidence ratings and competence ratings across time.
The comparison between all points of confidence and competence as a bar graph highlights the changes in confidence ratings and the corresponding competence ratings. The low number of students with ratings of one for confidence and competence is very apparent. For ratings of two, the bar chart shows the discrepancy between the four points of confidence and competence. More students are rated as a two for competence even though across all four points, not as many students rated their confidence as a two. On the other end of the scale, for the ratings of four and five, there is a pattern of having a higher number of students selecting these rating categories during point one and point four. Lastly, many more students rated their confidence as a three at point three collection. At point two collection, the number of students selecting three is the closest to the competence rating. In the next section, the findings are presented in a different way in order to be compared to the Dunning-Kruger Effect (DKE).
**Compare: Dunning-Kruger Effect**

As discussed in chapters one and two, the Dunning-Krueger Effect (DKE) is the theoretical framework for this study. The DKE indicates that those who perform poorly (incompetent) often overestimate themselves and those who perform well (competent) often underestimate themselves. Figure 4.20 shows Kruger and Dunning’s results from three of their 1999 studies.

![Figure 4.20: Composite of the DKE findings.](image)

When comparing the findings from this study about the students’ average confidence ratings to the instructors’ competence ratings, the same pattern shown by Kruger and Dunning (1999) appears. Although the following figures do not match exactly, the overall pattern does show overestimation and underestimation.

**Point 1.** Figure 4.21 shows that plotting the confidence ratings from point one and the competence ratings produces a figure that is similar to the DKE effect.
Figure 4.2:1 Confidence and competence for point 1 (prior to PSM) similar to the DKE.

Although the pattern of overestimating and underestimating is not quite as dramatic as the DKE results, the pattern does exist in Figure 4.21. Those students whose ratings fell in the lowest categories of one and two for competence rated themselves as 2.5 and 3.04 respectively. The students rated as more competent underestimated. Students receiving a competence rating of four rated their confidence as a 3.75 and those receiving a competence rating of five rated their confidence as a 4.29.

**Point 2.** Figure 4.22 shows that plotting the average of the confidence ratings from point two and the competence ratings produces a figure that is similar to the DKE.
Figure 4.22: Confidence and competence for point 2 (start of PSM) similar to the DKE.

Again, the pattern of overestimation and underestimation is not as dramatic as the DKE figures. However, for point two a similar pattern of overestimation and underestimation is shown. Those students receiving a competence score of one indicated a confidence score of 2.5. Students in the competence rating category of two rated their confidence as a 2.76. The students in the middle for confidence rated their confidence as 3.29. As for the students underestimating, those with a competence rating of four rated their confidence as 3.53. Those students in the competence category of five rated their confidence as 4.

**Point 3.** Figure 4.23 shows that plotting the average of the confidence ratings from point three and the competence ratings produces a figure that is similar to the DKE.
Figure 4.23: Confidence and competence for point 3 (start of CTW) similar to the DKE.

For point three, the pattern of overestimation and underestimation is similar to point two and DKE. Those students receiving a competence score of one indicated a confidence score of 2.5, which is the same as it was for point two. Students in the competence rating category of two rated their confidence as a 2.74, which is very close to the ratings in point two. The students in the middle for confidence rated their confidence as 3.26, which again is very similar to point two. As for the students underestimating, those with a competence rating of four rated their confidence as 3.58. Those students in the competence category of five rated their confidence as 4, which is the same as point two.

Point 4. Figure 4.24 shows that plotting the confidence ratings from point four and the competence ratings produces a figure that is similar to the DKE.
Figure 4.24: Confidence and competence for point 4 (end of CTW) similar to the DKE.

Figure 4.24 shows the most similarity with the DKE figures. Students in the lowest competence rating of one rated their confidence as 3.5. Those in the competence rating category of two rated their confidence as 3.37. For the middle category of three for competence, students rated their confidence as 3.63. For the higher ratings, those in the competence category of four rated their confidence as 3.83, and those in the competence category of five rated their confidence as 3.86.

**Summary of All Four Points**

When examining all four points of confidence ratings and comparing to the competence ratings, point four shows the biggest overestimation for students in the competence categories of one and two. Also, at point four, students’ underestimation was higher for the competence category of five than any other categories. Figure 4.25 shows the average confidence ratings for all four points and the competence rating.
Figure 4.25: Confidence rating for all four points compared to competence.

Figure 4.25 displays all the confidence ratings with the competence ratings in a way that shows the similarities to the DKE. The pattern of overestimation and underestimation shows the incompetent (those rated as a one or two in competence) overestimate. On the other end of the continuum, high performers (those rated as a four or five in competence) underestimate. This figure also shows the changes over time. At point one, the confidence ratings and competence rating are the closest for the competence category of five. At point three, students’ confidence rating for the category of three is the closest to the competence rating.
Summary of Research Question Three

Research question three asked: how do students’ self-reported confidence ratings as measured four times within five months compare (equal to, overestimated, or underestimated,) to instructors’ competence ratings? In this section, percents were used to present the findings. The findings for this research question were compared to the Dunning-Kruger Effect.

While instructor competence ratings formed a bell-shaped curve, the four points of confidence collection do not. Point one and point three are closest to a bell-shaped distribution; however, points two and four are skewed left. At point three, the highest number of confidence ratings matched the competence ratings. The highest incidence of underestimating occurred at point two. Older men and older women were tied for rating their confidence lower than their competence rating. At point four, the most confidence ratings were higher than the competence ratings. Of those overestimating, older men’s confidence ratings were higher than their competence ratings. Point four was the only confidence collection point that did not have any rating in the category of one. Although all four points of confidence collection showed the pattern of the lowest performers (the incompetent) overestimating and the highest performers (competent) underestimating, point four is the strongest support for the DKE.

Research Question 4

Research question four asks if there is a statistically significant relationship between students’ self-reported confidence with presentation skills and instructors’ rating of their presentation competence? To answer research question four, Spearman’s correlations were calculated. The reason that Spearman’s correlation was selected over Pearson’s correlation is that the data is not interval. Spearman’s is used with ordinal data.
Different researchers interpret the correlation coefficients differently. To interpret the correlation coefficients according to Ravid (2014), 0-0.2 is negligible, 0.2-0.4 is low, 0.4-0.6 is moderate, 0.6-0.8 is high, and 0.8-1.9 is very high. Tanner (2012) uses only three categories: 0-0.33 is weak, 0.3-0.7 is moderate, and 0.7-1.0 is high. Wrench, Thomas-Maddox, Richmond, and McCroskey (2019) also use only three categories, but they are slightly different: 0-0.3 is weak, 0.3-0.59 is moderate, 0.6-1.0 is strong. McHugh (2018) indicates that 0-0.19 is very weak, 0.2-0.29 is weak, 0.3-0.49 is moderate, 0.5-0.69 is strong, and 0.7-1.0 is very strong. The problem with using Ravid, Tanner, or Wrench et al. is that their categories overlap. For instance, using Ravid’s (2014) categories, a correlation of 0.20 could be considered negligible or low. With Tanner (2012), a correlation of 0.7 could be either moderate or high. For Wrench et al. (2019) a correlation of 0.3 is either weak or moderate. For clarity, McHugh’s (2018) categories, which have more defined boundaries between the categories, were used to identify the strength of the correlations.

In the sections below, scatterplots of the data and the results of the Spearman’s correlations are presented for each of the four points of collection of students’ confidence ratings.

**Point 1 Correlation**

Figure 4.26 shows a scatter plot for the data for point one confidence ratings and competence ratings.
Figure 4.26: Scatterplot of point 1 (prior to PSM) and competence.

The scatter plot for point one shows a generally positive relationship. The relationship between point one confidence ratings and competence ratings resulted in \( r_s = 0.34 \), which is a moderate relationship.

**Point 2 Correlation**

Figure 4.27 shows a scatter plot for the data for point two confidence ratings and competence ratings.

Figure 4.27: Scatterplot of point 2 (start of PSM) and competence.
The scatter plot for point two shows a generally positive relationship. The relationship between point two confidence ratings and competence ratings resulted in \( r_s = 0.38 \), which is a moderate relationship.

**Point 3 Correlation**

Figure 4.28 shows a scatter plot for the data for point three confidence ratings and competence ratings.

![Figure 4.28: Scatterplot of point 3 (start of CTW) and competence.](image)

The scatter plot for point three shows a generally positive relationship. The relationship between point three confidence ratings and competence ratings resulted in \( r_s = 0.47 \), which is a moderate relationship.

**Point 4 Correlation**

Figure 4.29 shows a scatter plot for the data for point four confidence ratings and competence ratings.
Figure 4.29: Scatterplot of point 4 (end of CTW) and competence.

The scatter plot for point four shows a generally positive relationship. The relationship between point four confidence ratings and competence ratings resulted in $r_s = 0.47$, which is a moderate relationship.

**Summary of All Four Points**

Overall, the findings show generally positive correlations between the students’ confidence ratings and the instructors’ competence ratings. However, the correlations are not strong for any of the four points of collection. Table 4.17 shows a summary of the Spearman’s correlation for all four points of confidence rating.

**Table 4.17**

*Spearmann’s Correlation for All Four Points*

<table>
<thead>
<tr>
<th></th>
<th>Point 1</th>
<th>Point 2</th>
<th>Point 3</th>
<th>Point 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>rho</td>
<td>0.3394472</td>
<td>0.3793625</td>
<td>0.47452</td>
<td>0.474522</td>
</tr>
<tr>
<td>p-value</td>
<td>3.39e-07</td>
<td>9.12e-09</td>
<td>1.80e-13</td>
<td>1.80e-13</td>
</tr>
<tr>
<td>Relationship</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
As shown in Table 4.17, all four points of confidence ratings have a moderate relationship with the competence ratings according to McHugh’s (2018) categories. However, points one and two, are on the lower end of the moderate scale. If using a different researchers’ categories, points one and two could be considered low or weak. Points three and four fall within the moderate category across researchers. The examination of Spearman’s correlation shows that the relationship between the students’ confidence ratings and the instructors’ competence ratings of the students’ presentation skills is moderate.

**Summary of Research Question Four**

Spearman’s correlations were used to answer research question four about the relationship between students’ confidence ratings and instructors’ competence ratings. The correlation between the students’ self-reported confidence rating and instructors’ competence rating is generally positive for each point of collection. This means that as confidence ratings go up, competence ratings also tend to go up. Although the scatterplots show generally positive relationships, those relationships, when measured using Spearman’s correlations, are only moderate at best. However, the findings also indicate that the highest correlations occurred at point three and point four when students had been interacting with the instructors the longest.

**Research Question 5**

Research question five asks: Do sex and age significantly influence students’ self-assessed presentation confidence ratings? To answer this question, descriptive statistics and regression were used.

Of the 215 students in the study, 57% were men and 43% were women. The percentage of men and women in the students in the PSM is not indicative of the field of analytics. According to the 365 Data Science blog, the field of analytics is “dominated by men (69%)”
Of the 123 men in the PSM program, 72 (58.54%) were labeled as older and 51 (41.46%) were labeled as younger. Of the 92 women, 47 (51.09%) of the women were older, and 45 (48.91%) were younger.

R was used to run regressions on the four points of collection of confidence in order to determine if sex and age influenced the students’ confidence ratings. A p-value of 0.05 was used to determine significance. For each of the four points, the confidence ratings were the criterion or response variable and sex and age were the predictor variables. The sex variable was converted from the text of “women” and “men” into binary variables of 0 and 1. The age variable was converted from older (meaning 24 years and above) and younger (meaning 23 years and below) into binary variables of 0 and 1. In addition, a class variable, which was converted from “Class of 2019” and “Class of 2020” to binary variables of 0 and 1, was added to the model to control for interaction between the two different class years. The following sections present the findings from the multiple regression analysis for each of the four points of confidence ratings.

**Point 1 Multiple Regression Analysis**

Table 4.18 shows the results for the multiple regression analysis that determined whether sex and age influenced students’ confidence ratings for point one.
Table 4.18

Multiple Regression of Sex and Age’s Influence on Confidence Ratings for Point 1 (prior to PSM)

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>1Q</th>
<th>Median</th>
<th>3Q</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residuals</td>
<td>-2.4488</td>
<td>-0.4928</td>
<td>0.1951</td>
<td>0.6189</td>
<td>1.6828</td>
</tr>
</tbody>
</table>

Coefficients

|         | Estimate | Std.Error | t value | Pr(>|t|) |
|---------|----------|-----------|---------|---------|
| (Intercept) | 3.5779 | 0.1788 | 20.010 | <2e-16 *** |
| Sex      | -0.1291 | 0.2176 | -0.593 | 0.554   |
| Age      | -0.2607 | 0.2405 | -1.084 | 0.280   |
| Class    | -0.2567 | 0.2301 | -1.116 | 0.266   |
| Age:Class| 0.3207 | 0.2562 | 1.251  | 0.212   |
| Sex:Class| 0.2482 | 0.2573 | 0.965  | 0.336   |
| Sex:Age  | 0.3047 | 0.2584 | 1.179  | 0.240   |

Residual standard error: 0.924 on 208 degrees of freedom
Multiple R-squared: 0.02184, Adjusted R-squared: -0.006381
F-statistic: 0.7738 on 6 and 208 DF, p-value: 0.5913
Note: *** p<0.001

The results of the multiple linear regression that was done to examine the relationship between point one confidence rating and the predictor variables of sex and age indicates that neither of the variables influence the confidence ratings. Note that interactions between sex and age and class were also considered and did not indicate any influence on confidence ratings.
Point 2 Multiple Regression Analysis

Table 4.19 shows the results for the multiple regression analysis that determined whether sex and age influenced students’ confidence ratings for point two.

Table 4.19

*Multiple Regression of Sex and Age’s Influence on Confidence Ratings for Point 2 (start of PSM)*

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>1Q</th>
<th>Median</th>
<th>3Q</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residuals</td>
<td>-2.4061</td>
<td>-0.3738</td>
<td>-0.1399</td>
<td>0.7651</td>
<td>1.8657</td>
</tr>
</tbody>
</table>

Coefficients

|         | Estimate | Std.Error | t value | Pr(>|t|) |
|---------|----------|-----------|---------|---------|
| (Intercept) | 3.16424  | 0.16566   | 19.100  | <2e-16*** |
| Sex      | 0.07069  | 0.20165   | 0.351   | 0.726   |
| Age      | -0.04077 | 0.22280   | -0.183  | 0.855   |
| Class    | -0.02997 | 0.21318   | -0.141  | 0.888   |
| Age:Class| 0.04641  | 0.23741   | 0.195   | 0.845   |
| Sex:Class| -0.04881 | 0.23835   | -0.205  | 0.838   |
| Sex:Age  | 0.21196  | 0.23945   | 0.885   | 0.377   |

Residual standard error: 0.8561 on 208 degrees of freedom
Multiple R-squared: 0.01468, Adjusted R-squared: -0.01374
F-statistic: 0.5166 on 6 and 208 DF, p-value: 0.7954

Note: *** p<0.001

The results of the multiple linear regression that was done to examine the relationship between point two confidence rating and the predictor variables of sex and age indicates that neither of the variables influence the confidence ratings. Note that interactions between sex and age and class were also considered and did not indicate any influence on confidence ratings.
**Point 3 Multiple Regression Analysis**

Table 4.20 shows the results for the multiple regression analysis that determined whether sex and age influenced students’ confidence ratings for point three.

Table 4.20

*Multiple Regression of Sex and Age’s Influence on Confidence Ratings for Point 3 (start of CTW)*

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>1Q</th>
<th>Median</th>
<th>3Q</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residuals</td>
<td>-2.2864</td>
<td>-0.3007</td>
<td>-0.1423</td>
<td>0.6250</td>
<td>1.8036</td>
</tr>
</tbody>
</table>

| Coefficients      | Estimate  | Std.Error  | t value | Pr(>|t|) |
|-------------------|-----------|------------|---------|---------|
| (Intercept)       | 3.00550   | 0.13571    | 22.147  | <2e-16*** |
| Sex               | 0.19089   | 0.16519    | 1.156   | 0.249   |
| Age               | -0.06808  | 0.18251    | -0.373  | 0.710   |
| Class             | 0.28090   | 0.17463    | 1.609   | 0.109   |
| Age:Class         | 0.15673   | 0.19447    | 0.806   | 0.421   |
| Sex:Class         | -0.17658  | 0.19525    | -0.904  | 0.367   |
| Sex:Age           | 0.01398   | 0.19614    | 0.071   | 0.943   |

Residual standard error: 0.7013 on 208 degrees of freedom
Multiple R-squared: 0.04146, Adjusted R-squared: 0.01381
F-statistic: 1.5 on 6 and 208 DF, p-value: 0.1797
Note: *** p<0.001

The results of the multiple linear regression that was done to examine the relationship between point three confidence rating and the predictor variables of sex and age indicates that
neither of the variables influence the confidence ratings. Note that interactions between sex and age and class were also considered and did not indicate any influence on confidence ratings.

**Point 4 Multiple Regression Analysis**

Table 4.21 shows the results for the multiple regression analysis that determined whether sex and age influenced students’ confidence ratings for point four.

**Table 4.21**

*Multiple Regression of Sex and Age’s Influence on Confidence Ratings for Point 4 (end of CTW)*

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>1Q</th>
<th>Median</th>
<th>3Q</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residuals</td>
<td>-1.8231</td>
<td>-0.4919</td>
<td>0.1769</td>
<td>0.4002</td>
<td>1.5623</td>
</tr>
</tbody>
</table>

|                  | Estimate         | Std.Error      | t value | Pr(|t|)  |
|------------------|------------------|----------------|---------|---------|
| (Intercept)      | 3.704052         | 0.139636       | 26.527  | <2e-16*** |
| Sex              | 0.118999         | 0.169969       | 0.700   | 0.485   |
| Age              | 0.007437         | 0.187795       | 0.040   | 0.968   |
| Class            | -0.212102        | 0.179685       | -1.180  | 0.239   |
| Age:Class        | 0.100361         | 0.200106       | 0.502   | 0.617   |
| Sex:Class        | -0.173295        | 0.200904       | -0.863  | 0.389   |
| Sex:Age          | -0.099688        | 0.201824       | -0.494  | 0.622   |

Residual standard error: 0.7216 on 208 degrees of freedom
Multiple R-squared:  0.03916, Adjusted R-squared:  0.01145
F-statistic: 1.413 on 6 and 208 DF, p-value: 0.211
Note: *** p<0.001

The results of the multiple linear regression that was done to examine the relationship between point four confidence rating and the predictor variables of sex and age indicates that
neither of the variables influence the confidence ratings. Note that interactions between sex and age and class were also considered and did not indicate any influence on confidence ratings.

**Summary**

This chapter reported the findings of the data collected for the study. Descriptive statistics of median, mode, and percents were used to answer research question one about students’ confidence ratings and research question two about instructors’ competence ratings. Research question three compared the findings about confidence and competence using percents. Spearman’s correlation was used to answer research question four about the relationship between students’ confidence rating and instructors’ competence ratings. Percents and regression were used to answer research question five about the influence of sex and age on students’ confidence ratings.

Three key findings were noted. First, this study affirms the work of Kruger and Dunning (1999) and shows evidence for the Dunning-Kruger Effect. Second, instructors’ ratings of competence have only a moderate correlation to students’ confidence ratings. Third, sex and age did not significantly influence students’ self-reported confidence scores.
CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

“Those who misjudge their competence, talent, or character may meet with disaster. To the extent that they misjudge their knowledge and learning, they may not perform to the best of their potential or reach the goals they set for themselves—in the classroom as well as in the transition to clinic, conference room, or corporation” (Dunning, 2006, p.1).

The purpose of this study was to examine 215 professional science master’s (PSM) degree students’ self-rated confidence with presentation skills and three instructors’ ratings of the students’ presentation competence. Using the Dunning-Kruger Effect (DKE) as the theoretical framework and inspired by the methodology of the scholarship of teaching and learning (SoTL), this study looked at four points of measurement of students’ self-rated confidence with presentations and compared the students’ ratings to instructors’ ratings of the students’ presentation competence. The study had five main objectives. The first objective was to describe the students’ confidence ratings for their presentation skills that were collected four times on ungraded exercises. The second objective was to describe the instructors’ ratings of presentation competence. The instructors’ competence ratings were not grades, but rather used as categories for providing presentation skills support. The third objective was to compare the students’ confidence ratings with the instructors’ competence ratings. The fourth objective was to determine if a statistically significant relationship existed between students’ self-reported confidence with presentation skills and instructors’ rating of students’ presentation competence. The fifth objective was to determine if the variables of sex and age significantly influenced students’ self-assessed presentation confidence ratings.

Summary

The following section provides a brief summary of the five chapters. A discussion of the findings and recommendations for each research question follows the summary section. After the
recommendations, a section about limitations is followed by a section about future research that includes suggested next steps.

**Chapter 1**

Chapter one detailed the statement of the problem, the purpose of the study, the five research questions that guided the study, an overview of the research methodology, an introduction of the DKE as the theoretical framework, the conceptual framework, the setting, the significance of the study, definitions, and delimitations. Chapter one also included a positionality statement because this study used the researcher’s PSM students as the participants in the study.

Chapter one discussed PSM students completing PLUS courses as part of their required curriculum. PLUS courses include communication skills, and this research study focused on one aspect of communication: presentation skills needed to succeed during the PSM program and as future data professionals. The study examined students’ self-rated confidence with presentations and compared those ratings to instructors’ ratings of students’ competence with presentations. The theoretical framework for this study came from Kruger and Dunning’s (1999) work with overestimation and underestimation that came to be called the Dunning-Kruger Effect.

**Chapter 2**

Chapter 2 presented and reviewed theories about confidence and competence. The literature reviewed about confidence was focused on self-assessed confidence. For competence, the literature reviewed focused on instructor-rated competence. In addition, Kruger and Dunning’s 1999 research about competence was reviewed by highlighting the findings about overestimation and underestimation from their four studies assessing humor, logic, grammar, and training. The literature review also included other studies that affirmed the DKE as well as a
discussion of the criticism of DKE. In addition, part of chapter two addressed the altering of the DKE model and the origins of the changes to the DKE model in the popular press.

**Chapter 3**

Chapter three presented the methodology of the study. With a focus on SoTL methodology, the research design, research questions, and variables used in the study were detailed. A discussion about the population of PSM students, their non-graded reflection exercises that provided the confidence ratings, and the instructors’ ratings of competence verified that appropriate measures were selected for this study. The steps for cleaning and analyzing the data were explained along with support for the particular choices of methods including descriptive statistics (median, mode, percents), Spearman’s correlations, and multiple regression. Chapter three ended with a discussion of the ethical considerations for the study.

**Chapter 4**

Chapter four reported the findings of the data collected for the study. Descriptive statistics of median, mode, and percents were used to answer research question one about students’ confidence ratings and research question two about instructors’ competence ratings. Research question three compared the findings about confidence and competence using percents. Spearman’s correlation was used to answer research question four about the relationship between students’ confidence rating and instructors’ competence ratings. Percents and regression were used to answer research question five about the influence of sex and age on students’ confidence ratings.
Chapter 5

This final chapter includes the discussion of the findings, recommendations, limitations, and suggestions. The discussion of the findings section is divided into the five research questions. For each research question, a summary of the findings and their conclusions is followed by recommendations based on the findings. The recommendations sections for each of the research questions include two parts. The first part contains the SoTL recommendations specifically for the researcher in her instructor role about what methods should be continued, expanded, or changed. The second part contains the practice and policy recommendations for other PSM programs and instructors. Next, limitations of the study are addressed. The chapter ends with suggestions for future research.

Discussion of Findings

Using a quantitative approach, this study used descriptive statistics (median, mode, and percents), Spearman’s correlations, and multiple linear regression to analyze the data from 215 PSM students’ ratings of their confidence in their presentation skills in comparison to three instructors’ competence ratings of students’ presentation skills. Three key findings stand out from this study. The first key finding is that this study joins the many studies from a wide range of disciplines and fields to affirm the work of Kruger and Dunning (1999). The findings indicate that the results of comparing PSM students’ self-reported confidence ratings and the instructors’ competence ratings are similar to the Dunning and Kruger Effect (DKE). The DKE shows that those scoring low in competence overestimate themselves and those scoring high in competence underestimate themselves. This pattern was present in all points of measurement of confidence in the study, but point four was the closest to the DKE pattern. The second key finding is that instructors’ ratings of competence have only a moderate correlation with students’ confidence
ratings. The third key finding is that sex and age did not significantly influence students’ self-reported confidence scores. The following five sections detail the specific findings for each of the five research questions.

Research Question 1 Findings

Research Question one asked what are the students’ self-reported confidence ratings as measured four times within five months of their presentation skills? Overall, this study found that the PSM students’ confidence ratings, collected over four months, fluctuate between a median and mode of three and four. At point one, a rating of four was the highest (37.7%). At point two, a rating of three was the highest (48.4%). At point three a rating of three was again the highest (56.7%). Finally, at point four a rating of four was the highest (48.4%).

The collection of confidence ratings occurred in March-May for point one, June for point two, July/August for point three, and August for point four. Self-assessment, such as the collection of confidence ratings about presentation skills used in this study, is an established and important part of life-long learning (Boud & Falchikov, 2006; Boud et al., 2013; Falchikov & Boud, 1989; Marienau, 1999; Reitmeier & Vrchota, 2009). Even though self-assessment is standard practice in education, problems with the accuracy and the process of self-assessment are also recognized (Anderson & Reid, 2013; Ward et al., 2002; Zell & Krizan, 2014). Despite concerns, the collection of the confidence ratings was foundational for this study and was undertaken with an understanding that self-assessment is potentially problematic.

The confidence ratings were collected each time the students had a communication course. However, this study focused on four specific points of collection. Point one occurred before the students started their PSM program. Point one served as a baseline for the students’ confidence in their presentation skills. Out of the four points of collection, more students rated
their confidence as a five at point one. More students rated their confidence as a four than any of the other categories for point one. Only three students rated their confidence as a one. Because students had not interacted with each other and had not learned about the full expectations of the PSM program, this initial rating provided an important glimpse into the students’ beliefs about their presentation confidence. These finding are consistent with other research that found that “the farther removed from the time a task is to be performed, the easier it is to be optimistic about success” (Gilovich, Kerr, & Medvec, 1993, p. 559). However, “as the time grows near, people become less inappropriately confident” (Dunning, 2005, p. 144).

Point two collection occurred after the students had met each other, completed orientation with faculty and staff, and gained a better understanding of the program. At point two fewer students selected five for their confidence rating (dropping from 12.6% to 5.6%). In addition, ratings of four went down (from 37.7% to 29.8%). Ratings of two stayed close to the same. Ratings of one rose slightly (from 1.4% to 2.79%). At point two, an increase in ratings of three possibly shows some calibration of confidence ratings based on the experiences students had at the start of the PSM program. Kruger and Dunning (1999) found in their study on grammar that “competent individuals would learn from observing the responses of others” (p. 1123). Although the purpose of the study was not to test for this particular finding, it seems plausible that the students were beginning to adjust their ratings based on the observations of their fellow classmates.

Point three collection shows an increase in ratings of three (from 48.4% up to 56.7%). This is the highest percentage of students rating their confidence as a three out of all four points. At point three there is a slight dip in the percentage of students rating a five (from 5.6% down to 2.8%) and an even slighter dip in students rating a four (from 29.8% down to 28.8%). Ratings of
two fell from 13.5% to 10.7%. Finally, only 0.93% of students selected one for a rating at point three. In addition, by the point three collection, the students had presented twice and had gotten specific feedback from the instructors about their presentation skills. These experiences may be reflected in the results for the point three collection. Not only are some students getting better at calibrating their ratings, they also have a clearer understanding of their own presentation abilities (competence) based on instructor feedback. This finding is in keeping with Russo and Schoemaker's (1992) findings that immediate feedback can limit overconfidence. The point three collection happened at the start of the Communication Training Workshop (CTW). The CTW is a rigorous four-day workshop focused on developing and/or honing the students’ presentation skills. The purpose of the CTW is to improve students’ confidence with presentations and provide low-stakes opportunities for practice in order to improve presentation competence. As part of the PLUS curriculum, the CTW is a required class that is usually the source of some stress and apprehension.

The point four collection occurred at the end of the CTW, which is just three days after the collection of point three ratings. The third point of collection and the fourth point of collection are not spaced out like the other points of collection. Again, the timing of these two collections of confidence ratings need to be considered when examining the findings for research question one. What is most surprising about the findings for point four is that there is an increase in the number of students rating a four for confidence. At point three, 28.8% of the students rated themselves a four; however, at point four, 48.4% rated themselves a four. In addition, the percent of students rating their confidence as a five increased (from 2.8% to 9.3%). No one rated themselves as a one, and those rating themselves a two decreased from 10.7% down to 5.1%. It is possible that the increases in ratings of four and five are the result of the communication
training. Quail, Brundage, Spitalnick, Allen, & Beilby (2016) found in undergraduate health professionals that “a single communication training experience can bring about positive changes in a student’s communication self-efficacy” (p. 10). The findings for research question one suggest that students felt more confident about their presentation skills than they have at any other point of collection, including prior to starting the program. In no way can this finding suggest that the students’ competence with presentation skills also increased so dramatically. In a study about developing written communication skills, Pajares and Johnson (1994) “warn that increasing students' self-confidence in an academic endeavor is no panacea for the development of competence” (p. 328). So, this finding that the students rated themselves highest at point four is encouraging in that their confidence ratings increased overall; however, is not indicative of actual performance as measured by competence ratings from the instructors. The higher rating of confidence at point four does align perfectly with the first purpose of the CTW: to increase students’ confidence with their presentation skills. Although confidence is considered to be an “unreliable gauge of how much has been learned” (Finn & Tauber, 2015, p. 569), it is a belief that may help students achieve better outcomes (Pajares & Johnson, 1994). “Confidence is a quality of self-efficacy that tends to correlate in empirical studies with persistence in the face of obstacles and higher achievement” (Duffy & Holmboe, 2006, p. 1138). The researcher wants students to have this feeling of confidence to help them improve their presentation skills, which will be needed during their PSM program and in their future careers as analysts.

The first objective of this study was to examine the PSM students’ confidence ratings using median, mode, and percents. The findings suggest that students may have adjusted their confidence ratings based on their experiences with their classmates and faculty. The researcher has collected confidence ratings for many years prior to this study. However, this is the first time
the researcher has analyzed the data using SoTL best practices. The results are not surprising and reflect the general assumptions that the researcher operated under prior to the study: students adjust their confidence levels as they gain more experience. An unexpected finding is the notable increase in confidence ratings at point four. However, this is positive information. The findings from research question one can inform the researcher’s future offerings of CTW and can contribute to the research about PSMs and confidence with presentation skills.

**Research Question 1 Recommendations**

Based on the findings for research question one about students’ confidence ratings, the following recommendations are provided for both the researcher (SoTL Recommendations section) and other PSM practitioners and policy makers (Practice and Policy Recommendations section).

**SoTL Recommendations.** The SoTL recommendations are divided into three categories: continue, expand, and change. These recommendations are intended for the researcher in order to improve teaching and student learning. Based on the findings from research question one, the researcher should continue to collect confidence ratings with future classes of students. Not only will that increase the participant numbers for future analysis, but it will also allow the topic of confidence to be a continued aspect of communication training. The collection of confidence rating should continue to use a five-point Likert scale. Despite some of the typical concerns about Likert scale data, a five-point scale is appropriate and captures the information in a relatable way. Although the confidence (and competence) ratings are not grades, the five-point scale maps on nicely to the typical grades of A, B, C, D, F that students and teachers are comfortable using. The researcher should continue to provide feedback to help students learn to calibrate their confidence scores.
The researcher should expand the number of times the confidence pie chart is shared. During the time that was used for this study, the students only saw the pie chart at the very beginning of the PSM program. If students can see the confidence pie chart more often, they would be able to see where they are in comparison with their peers. As a result, students may be able to better calibrate their own self-assessments.

The researcher should change the information provided on the Likert-scale for collecting confidence ratings from the students by labeling each number on the scale. Currently the scale is from one to five with one labeled “not confident” and five labeled “very confident.” Adding descriptors to all the choices in between could help alleviate some of the issues often associated with self-assessment ratings. The label for the rating of one could remain “not confident,” and the label for the rating of five could remain “very confident.” For the rating of two, a label of “somewhat confident” should be added. For the rating of three, a label of “moderately confident” should be added. For the rating of four, a label of “confident” should be added. In addition, graphics could be added to enhance the distinctions between each rating category. Inspired by pain assessment scales used in hospitals, something like Figure 5.1 could be implemented.

![Diagram](image)

Figure 5.1: Potential future scale for confidence rating for students
**Practice and Policy Recommendations.** Two recommendations for practice and policy for all PSM programs came from the findings for research question one. The first recommendation is to implement opportunities to practice and improve self-assessment. PSM PLUS courses can include opportunities to self-assess confidence in the many soft skills areas that are covered. This additional skill of self-assessment could complement the transferable skills that are so valued by employers. Second, PSM programs should ensure that PLUS courses in communication provide appropriate individualized feedback for presentation skills. This is particularly challenging because PSM programs take different approaches to teaching PLUS skills. As noted by Harkins and Strausbaugh (2017), the most common way of teaching PLUS courses is “jointly taught by faculty and individuals outside the institution” (p. 6). Having a policy that encourages best practice in providing feedback could be helpful. As is suggested in the findings of research question one, the feedback and experiences that students have with presentations may influence their confidence ratings.

**Research Question 2 Findings**

Research Question two asked what are the instructors’ competence ratings of students’ presentation skills? Overall, the findings indicate that the instructors’ ratings of students’ competence formed a bell-shaped curve. Most students received a rating of three (the mode and median for competence was a three). The competence ratings were as follows: rating of one was 1.9%, rating of two was 25.1%, rating of three was 45.1%, rating of four was 24.7%, and rating of five was 3.3%. Although it was not the intention of the instructors to force a certain number of students into pre-determined ratings categories, it is important to note the distribution of the ratings by the three instructors. Concerns about grading on a curve (Bailey & Steed, 2012) are not relevant in this situation for two reasons. First, it was not a goal of the instructors to place
students’ competence ratings on a bell-shaped curve. Second, the competence ratings are not grades, but are categories used to identify what support students need for their presentation skills. A more robust discussion of grading and rating practices is outside the scope of this study; however, the use of three instructors to assign the ratings does eliminate some of the concerns associated with teacher variation in grading (Brookhart et al., 2016). The findings suggest that the current ratings assigned by the three instructors capture the students’ competence appropriately.

The competence ratings were created by the three instructors at the end of the CTW. Each instructor individually rated each student. Then, the instructors came to consensus on a rating for each student. Using the scale described in chapter three of novice, beginner, average, proficient, and expert, each student was placed in a category that indicated what presentation support that student needed during the PSM program.

The second objective of this study was to examine the instructors’ competence ratings for the students’ presentation skills. Using median, mode, and percents to analyze the data provided the researcher with valuable information. Although the competence ratings have been collected and used for many years, this study was the first systematic and data-driven review of the competence data. The findings from research question two can inform future training of any new instructors for the CTW and can serve as a check on appropriate rating practices for the instructors.

**Research Question 2 Recommendations**

Based on the findings for research question two about instructors’ competence ratings of students’ presentation skills, the following recommendations are provided for both the researcher
SoTL Recommendations. The SoTL recommendations for research question two are divided into two categories: continue and expand. These recommendations are intended for the researcher in order to improve teaching and student learning. Based on the findings from research question two, the researcher should continue to use multiple instructors to establish competence ratings and expand what students receive in terms of feedback.

In order to avoid some of the common concerns about instructor ratings, the use of multiple instructors to establish competence ratings should be continued. Although the process is time consuming, coming to consensus for ratings for each of the students is valuable. Being able to base the rating on multiple presentation opportunities (introduction, impromptu, 5-minute visualization, and team) to form the input from the three instructors gives a much better rating than from just one instructor.

In the future, the instructor/researcher should expand the feedback that is shared with students by providing them with their competence rating. Originally, the researcher intended to separate the idea of a grade for the CTW because the workshop is designed to improve confidence in presentation skills and offer opportunities to practice in order to improve presentation competence. So, the decision was made to simply give students feedback without any numerical indication of their competence. The students received feedback about what went well and what to improve on in the form of verbal comments at the time of the presentation and written comments after the presentation. The students did not receive the competence scores directly. Instead, the competence scores were converted into the written feedback about how to improve their presentations and what resources are available for them. Students rating a five in
competence were asked to be role models for other students during future presentations and while working within their team. Students with competence ratings of four were encouraged to make minor adjustments to improve their already strong presentation skills. Students receiving a competence rating of three were told about their strengths and areas for improvement. Students rated as a two in competence were told about their strengths and areas for improvement and were encouraged to attend workshops to improve their skills. Students with a rating of one were told about their strengths and areas for improvement and were instructed to attend workshops and meet with the instructor. Just like sharing the confidence ratings with students, as is recommended above, sharing the competence ratings could help students improve their self-assessments skills. It is recommended that for the next iteration of the CTW that students receive their competence rating along with their written feedback.

**Practice and Policy Recommendations.** One recommendation for practice and policy for all PSM programs came from the findings for research question two. It is recommended that instructors, whether they are tenure-track faculty associated with the PSM program, non-tenure track faculty, affiliated faculty, or industry representatives (Harkins & Strausbaugh, 2017), critically examine their own rating and feedback practices. Feedback norming activities with instructors, especially those outside the university, could provide students with consistent and less biased feedback. Although it would be an unmanageable strain on resources to provide multiple instructors for feedback for all assignments, establishing (or reviewing existing) general best practices in feedback could be an important step for PSM programs to take to ensure the quality of the PLUS courses.
Research Question 3 Findings

Research Question three asks how do students’ self-reported confidence ratings as measured four times within five months compare (equal to, overestimated, or underestimated) to instructors’ competence ratings? Overall, this study found that students’ pattern of underestimation and overestimation is similar to the pattern shown in the DKE. In addition, the findings seem to suggest that most students’ rating of their confidence could have changed based on their experiences with presentation skill development. Although this study was not designed to test for the reasons that students selected different confidence ratings, the findings show that changes occurred between collection points. The remainder of this section addresses the issues of student and instructor ratings, self-assessment, and how they may be interpreted in this study.

Studies have found that instructors ratings differ from students ratings (Falchikov & Boud, 1989; Patton, 2019; Suñol et al., 2016), so it is not surprising that the findings indicate that both overestimation and underestimation occurred in this study. Point one had 47.4% overestimated, point two had 38.6% overestimated, point three had 35.8% overestimated, and point four had 57.2% overestimated. These findings are in agreement with other studies about overestimation of skills (Kruger & Dunning, 1999). “People are not adept at spotting the limits of their knowledge and expertise. Indeed, in many social and intellectual domains, people are unaware of their incompetence, innocent of their ignorance” (Dunning, Johnson, Ehrlinger, & Kruger, 2003, p. 83).

On the other end of the spectrum, underestimation findings also indicated a disconnect between instructor rating and student rating. One possible reason for underestimation is that “experts underestimate themselves by overestimating others” (Wright, 2018, p. 10). Dunning (2005) says that this happens because “top performers suffer from a false consensus effect” (p.
meaning that they assume that everyone is as skilled as they are. In this study, the consensus effect may be present at point two. Point one had 17.2% underestimated, point two had 22.8% underestimated, point three had 18.1% underestimated, and point four had 13.5% underestimated. Between point one and point two, twenty fewer students overestimated (dropping from 47.4% at point one to 38.6% at point two). This recalibration of confidence may be attributed to the students meeting each other and starting the PSM program between point one collection and point two. The notable change from point two to point three is that both overestimation and underestimation decreased. Point three had the highest percentage (46.0%) of confidence ratings that were equal to the competence ratings. This may be attributed to the students delivering presentations and receiving feedback from the faculty between point two and point three collection. It is interesting to note that the biggest overestimation (57.2%) occurred at point four, which also had the smallest percentage of underestimation (13.5%). The reason for all these changes between collection points may be reflected in Dunning’s (2005) assertion that “observing the performances of others help the competent to achieve more accurate views of themselves but does not necessarily help the incompetent” (p. 27).

It is important to note that 48 of the 215 students selected the same rating for all four points of confidence. One older female who rated her confidence as a five also was rated as a five for competence by the instructors. She is an example of an expert speaker with equal confidence and competence scores. Two of the students (one younger woman and one older man) who rated themselves a five on all four points were rated as fours in competence by the instructors. The difference between a four and five for competence, while important, is only a one-point difference between “proficient” and “expert.”
Other instances of miscalibration are more noteworthy. One older man who rated himself as a five on all four points was rated as a three by the instructors. The difference between a three ("average") and a five ("expert") shows the DKE pattern of poorer performers overestimating. One younger woman rated her confidence as a three on all four points but was rated as a one for competence. These two students may have preconceived ideas about their speaking abilities. Dunning (2005) indicated that “people's perceptions about the quality of their performances are based at least in part on preconceived notions they have about their skill” (p. 55), which could account for the miscalibration. Another explanation for the miscalibration is the refusal to accept the feedback offered between points two, three, and four. “Low performers have multiple escape routes for avoiding the acceptance of negative feedback” (Sheldon, Dunning, & Ames, 2014, p. 134). A third explanation for the miscalibration is that the students did not honestly respond to the confidence question and instead just entered the same number each time without actually assessing their feelings of confidence. A fourth possibility is that the students used the Likert scale differently than the instructors used it. Whatever the case for the miscalibration, although outside the scope of the study, identifying that there are challenges with self-ratings is informative for the researcher.

In general, “self-ratings are poorly correlated with other performance measures. Still, many educators view the ability to recognize and communicate one’s deficiencies as an important component of adult learning” (Eva et al., 2004, p. 211). The research comparing students’ self-assessments with instructors’ ratings is divided between research about overrating and research about underrating. However, according to the studies of undergraduates reviewed by Boud and Falchikov (1989), there was not a discernible trend to indicate that students overestimate or underestimate more often. However, in 1999, Kruger and Dunning’s studies,
which introduced the idea that later became known as the DKE, indicated that they did find that poor performers tend to overestimate, and high performers tend to underestimate. A pattern similar to the DKE was discovered with the PSM students’ rating of their confidence as compared to instructor-rated competence. However, the miscalibration was not as severe as it was in the Kruger and Dunning studies. Kruger and Dunning’s (1999) studies showed that “bottom-quartile participants were nearly four times more miscalibrated—than their top-quartile counterparts” (p. 1131). The findings of the current study do indicate similar miscalibration, but they do not mirror the extreme levels of miscalibration. Part of that difference may be the scale that was used by Kruger and Dunning was from 1-100. Because this current research study used a scale of 1-5, the discrepancies do not show the same magnitude as the Kruger and Dunning studies. Another reason that the current study reflects the DKE pattern of overestimation and underestimation but not as dramatically may be the nature of delivering presentations. Kruger and Dunning’s studies were done using written tests, which are an intellectual challenge. A presentation requires both intellectual and physical skills. Many of the difficulties that people face when delivering a presentation are physical (Daly et al., 1997; Elfering & Grebner, 2011; Jackson et al., 2017) and those physical challenges like increased heart rate, flushing, and rapid breathing, may influence students’ confidence ratings. Dunning (2005) indicated that “people produce much better estimates of their athletic skills... than they do of intellectual and social skills” (p. 25). The ability to assess the physical aspect of presentations may be similar to the ability to assess athletic skills.

Although a similar pattern exists between the DKE graphs and all four points of confidence collection, it is point four that most closely resembles the DKE graph. Students in the lowest rating of one for competence overestimated by rating their confidence as a 3.5. Students
in the highest rating of five for competence underestimated by rating their confidence as 3.86. Although it may be easy to dismiss students’ overestimation as a character flaw, Dunning (2005) warns that we “should not attribute self-judgment errors to arrogance, even if the judgments people tend to reach about themselves tend to be conceited ones, given how those judgments compare with objective reality” (p. 163). For this case, the objective reality comes from the instructors’ competence ratings and the disconnect between the ratings should not be considered a failure of the students or the instructors. During an interview, David Dunning said “So, one way to think about confidence is that it has its bad sides and it has its good sides. So, it ultimately turns out to be something that you need to manage” (McRaney, 2014). Overconfidence does have benefits: people respond positively to confidence (Dunning, 2005), overconfidence can help with completing difficult tasks, persevering (Baartman & Ruijs, 2011), and escaping stress (Sanchez & Dunning, 2018). On the other hand, overconfidence can “lead to complacency” (Dunning, 2005, p. 176), “risk taking, errors, conflict” (Sanchez & Dunning, 2018, p. 10), and poor decisions (Callender et al., 2016).

The researcher views the students’ overestimation at point four not as a true failure of self-assessment, but as a step in the process of learning to better self-assess presentation skills and ultimately improve presentation competence. The overestimation at point four could be the result of students feeling safe and supported during the CTW. Therefore, they rated their confidence in their abilities higher than at any other point of collection. The goal of the CTW is to improve confidence, and it seems that the findings for research question three could indicate that the goal may have been achieved. A study by Sanchez and Dunning (2018) found that “although beginners start with humble self-perceptions, with just a little experience their confidence races ahead of their actual performance” (p. 10). This may be the case with the
students’ presentation confidence. Building presentation confidence could help students work on their presentation competence in the future.

The third objective of this study was to compare the students’ confidence ratings with the instructors’ competence ratings. The findings show that students’ patterns of overestimation and underestimation is similar to the DKE. Although the presence of the DKE has been documented in many studies, the researcher was surprised to see that the pattern was most similar to DKE at point four collection of confidence. What can be implied by this finding is that the CTW is achieving its goal of increasing student confidence with presentations. However, in just four days, students’ competence did not keep pace with their confidence. This has long-reaching implications for the PSM students and the presentation curriculum. Building off the students’ confidence from CTW will be an important aspect of developing students’ competence during the rest of the program.

**Research Question 3 Recommendations**

Based on the findings for research question three about comparing students’ confidence ratings with instructors’ competence ratings, the following recommendations are provided for both the researcher (SoTL Recommendations section) and other PSM practitioners and policy makers (Practice and Policy Recommendations section).

**SoTL Recommendations.** The SoTL recommendations for research question three are divided into two categories: continue and expand. The researcher should continue to collect confidence and competence ratings and conduct the same analysis to compare the ratings for future classes of PSM students. Examining the equal/over/under estimation splits will help the researcher better understand which students may need support in assessing their presentation skills accurately. This recommendation does not require additional work for either the researcher
or the students because collecting the confidence ratings is already part of the lesson plan and dividing the students into competence rating categories is already part of the assessment and feedback process. To improve on this process, the researcher can use an interactive dashboard to visualize the students’ confidence and competence.

The researcher should expand the use of video to support students’ understanding of their presentation skills. Currently, during the CTW, students are required to record the first two presentations they deliver. As part of a reflective exercise, the students watch their videos and develop an action plan based on the videos and feedback from peers and instructors. The use of video to improve presentation skills is a common educational practice (Ritchie, 2016). Incorporating more opportunities for recording presentations not only has the potential to improve presentation skills, but it can also be a way for students to develop better self-assessment skills (LeFebvre, LeFebvre, Blackburn, & Boyd, 2015).

The researcher should expand her use of the want/need matrix for presentation skills that she developed many years ago. The original want/need matrix for presentation skills is shown in Figure 5.2.
Figure 5.2: Want and need matrix for presentation skills

The want/need matrix for presentation skills is made up of four quadrants. The first quadrant is labeled needs help and wants help, which means that these students are open to feedback in order to improve. They need “clear directions, opportunities for feedback, connections, experiences, and structured practice” (Persky & Robinson, 2017, p. 76). The second quadrant is for students who do not need help but want help. Another label for this quadrant could be students experiencing imposter phenomenon (IP). IP refers to the feeling of phoniness despite accomplishments (Clance & Imes, 1978). Although the original research about IP focused on women, both men and women can experience it (Cusack, Hughes, & Nuhu, 2013; Hutchins, 2015; Lane, 2015; Parkman, 2016) and it is common in university settings (Herrmann,
2019; Revuluri, 2019). Students in the second quadrant present well but doubt their abilities despite being told they are doing well. They seek out extra attention and support. The third quadrant of students do not need help and do not want help. This does not mean that they resist feedback, rather they are not actively looking for feedback because they have confidence in their established presentation skills. Students in the third quadrant are more self-regulated than those students in the first quadrant and do not need as many guidelines to be successful (Persky & Robinson, 2017). The best presenters are open to recommendations for improvement and are able to apply feedback rather easily. The final quadrant includes students who need help, but do not want help. These students would be described by Kruger and Dunning (1999) as being incompetent. The students in the fourth quadrant are ignorant of their own incompetence. As a result, they are resistant to feedback about areas of improvement. These students may have arrived at the fourth quadrant because they received praise for previous presentation experiences. A miscalibration of confidence and competence stemming from a lack of metacognition (Kruger & Dunning, 1999) or a lack of ability to accurately self-assess (Dunning, Heath, & Suls, 2004, p. 69) could have influenced their attitude toward improving their presentation skills. Whatever the case, the students in the fourth quadrant are in need of improvement but are blind to their deficiencies, despite being told.

Prior to this study, the want/need matrix for presentation skills was used by the researcher based on general impressions of the students’ skills and a cursory review of the confidence and competence ratings. Although helpful in identifying approaches to support students in each quadrant, by expanding the use of the matrix to incorporate findings from this study, the want/need matrix for presentation skills could be even more useful for the researcher and potentially for other PSM instructors.
The want/need presentation matrix can be used in conjunction with the findings from this study. Mapping the results of confidence and competence ratings onto the four quadrants, while keeping equal estimation, overestimation, and underestimation in mind, provides the researcher with additional information about how to best serve the needs of the students in her PSM program. The expanded need/want matrix for presentation skills that incorporates the findings from this study appears in Figure 5.3.

Figure 5.3: Updated want/need matrix for presentation skills with findings from study

Quadrant one, the rookies, would include the students receiving a rating of one, two, or three in competence who did not overestimate or underestimate their confidence ratings by more than one point. The rookie students can be supported through examples, opportunities to practice,
and step-by-step procedures (Persky & Robinson, 2017). Quadrant two, the underconfident, would include students rating a four or five in competence who consistently underestimated, especially those who underestimated by two points. Underconfident students can be supported by teaching them about IP and encouraging them to apply some of the strategies to combat IP such as focusing on accomplishments, avoiding comparisons, and accepting feedback (Revuluri, 2019). In addition, providing specific feedback, using video, and offering opportunities for practice can help the underconfident students improve their presentation skills. Students in quadrant one and quadrant two could benefit from working together to develop and hone presentation skills in a low-stakes environment.

Experts in quadrant three would include students receiving a competence rating of four or five who did not underestimate by more than one point. The experts do not seek out or need intervention from the instructor, but they still need support. First, the feedback about what was done well must be explicit and the experts must be encouraged to continue to grow and improve their skills—even if it is just to polish already strong presentation skills. Experts should be encouraged to share their knowledge with classmates (Persky & Robinson, 2017) and be role models for students in quadrants one, two, and four. Students in quadrant four, overconfident students, are students who overestimated by two or three points. These students present the biggest challenge because of their misconception of their skills. Despite feedback from instructors and peers, students in the overconfident quadrant fail to calibrate their confidence ratings. It is possible that these students only seek or accept feedback that is congruent with their own thinking (Dunning, 1995). Their overconfidence can lead to poor decisions (Callender et al., 2016) such as not investing time or effort into improving presentation skills. Dunning (2011) warns that “many poor performers push back. They rebel against the advice; they argue points of
view that contradict their own” (p. 286). To overcome the challenge of teaching the overconfident student, providing multiple sources of feedback including self-assessment, peer assessment, and instructor assessment can help highlight areas of improvement. The use of video and the opportunity to self-assess performances can also give the overconfident student a chance to calibrate. In addition, Dunning (2006) supports the idea of distributed training, self-testing, and peer feedback to address the issue of misjudging skills. Using the updated matrix, the researcher can more systematically support students in the development of their presentation skills during their PSM program. Other PSM instructors could also use this matrix, which is discussed in the next section along with other recommendations for policy and practice.

**Practice and Policy Recommendations.** Three recommendations for practice and policy for all PSM programs came from the findings for research question three. First, it is recommended that other PSM PLUS communication courses incorporate an analysis of students’ soft skills confidence ratings and competence ratings. Following the model outlined in this study and using the interactive dashboard created by the researcher as a guide for other PSM programs, students’ confidence ratings could be gathered at strategic times and compared to competence ratings assigned by preferably more than one expert—possibly combining academic and industry experts. In addition, instructors of PLUS courses could use the want/need matrix to identify the ways that students could be supported in their efforts to develop their presentation skills.

The third recommendation is to create a module to be shared with other PSM program that supports students’ ability to self-assess and seek and accept feedback. Research shows that students can be trained to better self-assess (Falchikov & Boud, 1989; Thawabieh, 2017). Because the challenge of self-assessment is not unique to this study, other PSM PLUS communication courses could benefit from a module that could be incorporated into whatever
form of communication training is used at that PSM institution. Activities in the model could include reviewing video examples of presentations, practicing providing feedback, assessing their own presentations, assessing their peers’ presentations, learning about IP, and constructing an action plan for improvements.

**Research Question 4 Findings**

Research Question four asks if there is a statistically significant relationship between students’ self-reported confidence with presentation skills and instructors’ rating of their presentation competence? Overall, this study found that a positive moderate relationship exists between students’ confidence ratings and instructors’ competence ratings. This finding is consistent with many other studies that indicate that student ratings and instructor ratings differ (Campbell et al., 2001; De Grez et al., 2012; Dunning et al., 2004; Falchikov & Boud, 1989; Patton, 2019; Suñol et al., 2016). Research in the medical profession have found that “confidence is not correlated with technical ability” (Shah et al., 2018). The findings from this study indicate that the moderate relationship between the students’ confidence ratings and the instructors’ competence ratings does increase slightly from point one to point four. At point one, the Spearman’s correlation is 0.34. At point two the correlation is 0.38. At points three and four, the Spearman’s correlation is 0.47. Even though 0.47 is still in the moderate category, the findings suggest a slight change in correlation between points two and three. This may be because the students are more familiar with the main instructor and the expectations of the presentations, and they are starting to calibrate their ratings.

As discussed in the research question one, self-assessment is challenging. For students’ confidence ratings to have a more significant relationship with instructors’ competence ratings, students’ self-assessment skills must improve. Improving self-assessment abilities is challenging
because “knowing thyself is a very difficult task” (Dunning, 2006, p. 2). Although observing others’ behavior is one way that high performers calibrate their own self-assessments, low performers are not as adept at making adjustments based on observation (Dunning, 2011). The findings from this study support the idea that just observing better presentations does not necessarily result in confidence ratings that are highly correlated with competence ratings.

The fourth objective of this study was to determine if a statistically significant relation existed between students’ ratings and instructors’ ratings. The findings indicate that a relationship does exist, but it is only a moderate relationship. These results are expected; however, they can inform the researcher’s future efforts to increase students’ ability to accurately self-assess.

**Research Question 4 Recommendations**

Based on the findings for research question four about the relationship between students’ self-reported confidence with presentation skills and instructors’ rating of their presentation competence, the following recommendations are provided for both the researcher (SoTL Recommendations section) and other PSM practitioners and policy makers (Practice and Policy Recommendations section).

**SoTL Recommendations.** The SoTL recommendations for research question four are divided into two categories: continue and expand. The instructor should continue to analyze student confidence ratings and instructor competence ratings as part of the CTW. Although this study was intended to examine two classes of data, the findings have been so helpful that the researcher should maintain the analysis with future classes.

The instructor should expand the CTW to include specific training in self-assessment of presentation competence. Currently, a discussion of growth mindset is part of the CTW, but it is
covered in a general sense and not as a specific exercise designed to improve metacognition. Growth mindset is a belief that intelligence can be developed (Dweck, 2006). Guillory and Blankson (2017) advocate for metacognitive instruction to improve growth mindset. Although promoting a growth mindset is a laudable goal on its own, it also has direct ties to this study. First, a growth mindset “has the potential to improve students’ academic performance and reduce their calibration error” (Ravenscroft, Waymire, & West, 2012, p. 709). Second, a fixed mindset, which is the opposite of a growth mindset, “promotes greater overconfidence” (Ehrlinger, Mitchum, & Dweck, 2016, p. 98), which can show up as miscalibrated self-assessment. The findings suggest that specific training in self-assessment could result in ratings from students that better correlate with ratings from instructors. This would be an important addition to the CTW because as Boud and Falchikov (2006) state:

preparing students for lifelong learning necessarily involves preparing them for the tasks of making complex judgements about their own work and that of others and for making decisions in the uncertain and unpredictable circumstances in which they will find themselves in the future. (p. 402)

Metacognition, “the ability to know how well one is performing, when one is likely to be accurate in judgment, and when one is likely to be in error” (Kruger & Dunning, 1999, p. 1121), is challenging to develop. However, because metacognition is a “crucial element in lifelong learning” (Ravenscroft, Waymire, & West, 2012, p. 707) it should be nurtured. Metacognition is important because “accurate self-assessment is valuable all the way up the educational ladder. However, it is especially crucial in higher education and professional school settings” (Dunning et al., 2004, p. 85).
**Practice and Policy Recommendations.** Two recommendation for practice and policy for all PSM programs came from the findings for research question four. These recommendations are identical to the recommendations for research question three. It is recommended that PSMs incorporate an analysis of students’ soft skills confidence ratings and competence ratings in their PLUS communication courses. The second recommendation is to create a module to be shared with other PSM program that supports students’ ability to self-assess and seek and accept feedback.

**Research Question 5 Findings**

Research question five asks if sex and age significantly influence students’ self-assessed presentation confidence ratings? Overall, this study found that sex and age did not significantly influence students’ confidence ratings. Research question five was inspired by one line in Kruger and Dunning’s (1999) study that stated: “gender failed to qualify any results in this or any of the studies reported in this article, and thus receives no further mention” (p. 1123). It is important to note that they used the term “gender,” but this study uses the term “sex.” The researcher was surprised by Kruger and Dunning’s statement that gender did not influence their results because it did not match up with the researcher’s beliefs based on her years of experience teaching men and women presentation skills. In addition, much of the literature supports the belief that women underestimate themselves.

Many studies indicate a difference between men and women in terms of their confidence and self-assessment. Bengtsson, Persson, and Willenhag (2005) stated that “there is a clear difference in self-assessment between men and women” (p. 202). Schulz and Thöni (2016) stated that “in almost all fields of study we find that females exhibit lower confidence than males” (p. 3). Overall, studies that did find a difference in self-assessment and confidence indicate that
women tend to underestimate (De Grez et al., 2012; Langan et al., 2008; Minter et al., 2005) and men tend to overestimate (De Grez et al., 2012). Langan et al., (2008) found “a strong effect of gender” (p. 179). Research about presentation anxiety indicate that “significant gender-based pattern differences were discovered with higher anxiety patterns reported by female speakers” (Behnke & Sawyer, 2000, p. 187). This research and the researchers’ experience in the communication classroom, led to the assumption that sex would influence the confidence ratings in this study.

Looking deeper into the research, Kruger and Dunning are not alone in finding that gender/sex does not influence self-assessment. Torres-Guijarro and Bengoechea (2017) claim that a review of the literature on peer and self-assessment indicates the effects of gender are inconclusive. On a more decisive note, Santiago and Einarson (1998) state that “gender was not found to be a significant factor in predicting academic self-confidence, academic self-efficacy, or career-related outcome expectations” (p. 163). These studies stand in sharp contrast to the studies that did note that gender/sex influences confidence and self-assessments.

The finding of this study that sex did not influence the confidence ratings of the PSM students was unexpected. However, a few possible explanations must be explored to understand these findings within the context of the PSM program. First, the population must be considered. Many of the students in the PSM program have been in STEM throughout their educational career. This means that women in the PSM program have persevered in a field that is typically male dominated. Research in gender issues in undergraduate engineering, which has similarities to the field of analytics, indicates that “women’s lack of this confidence, compared to men, reduces their likelihood of remaining in engineering majors and careers” (Cech et al., 2011, p. 641). In addition, “research indicates that females in engineering generally report lower self-
confidence and self-efficacy than males” (Litzler et al., 2014, p. 826). Because the women in the PSM program obviously completed their undergraduate work and have chosen a professional science master’s degree with the intent of working in analytics, it is possible that the research and assumptions about confidence and self-assessment, do not apply to them.

Second, the accuracy of the confidence scores should be considered. Did all students honestly assess their feelings of confidence and report their rating accurately? Did some students downplay their confidence because they placed more value on humility and modesty (Blanch et al., 2008)? Were students influenced by others in the classroom when entering their confidence ratings? Did students take the selection of confidence ratings seriously, or did they just enter the rating each time without thought? What were students’ preconceived notions about presentations, and how did they influence the confidence ratings? Dunning (2011) warns that:

People carry with them preconceived notions about whether they are good or bad at math, logic, counseling others, public speaking—the list is endless. And those preconceived notions color people’s evaluations of their performances—even their guesses about how well they have objectively done. (p. 280)

The purpose of research question five was not to determine why students select a specific confidence rating. Rather, the purpose was to examine whether sex and age had an influence on students’ confidence ratings. The researcher had assumed that sex and age would significantly influence students’ confidence ratings. When the findings indicated that this was not the case, the researcher reflected on why the expectation did not match the results of the regression analysis. Although not a specific research question, the researcher did additional analysis to determine the source of her own assumptions about overestimation and underestimation of confidence ratings.
To extend the analysis of research question five, the researcher examined who was doing the overestimating and who was doing the underestimating. As discussed in chapter four and shown in Table 4.15, more older men overestimated followed by younger men, then younger men, older women, and lastly younger women. Not only is the ranking of who overestimated important, but the degree of overestimation is noteworthy when examining why the researcher assumed that sex would influence confidence ratings. Of the 31 older men who overestimated, 26 overestimated by two points and five overestimated by three points. Three younger men, two older women, and one younger woman overestimated by three points. Fifteen younger men overestimated by two points. Eight older women overestimated by two points. Twenty-one younger women overestimated by two points.

Of course, because older men make up the largest percent (33.49%) of the study population, it would make sense that the frequency of older men who overestimate is higher. However, the impression is that more men overestimate because the number of men overestimating is higher than the number of women. For men, the count for overestimation was 49 and for women was 32. As a result, even though the regression results indicated that sex and age were not statistically significant, the impression made by the frequency of men overestimating influences the belief that sex influences confidence ratings. Most of the research indicated that men are more likely to overestimate, and this view was shared by the researcher; however, this study indicates that there is no significant difference for sex or age.

On the other end of the scale, the rate of underestimation by two or more points was not as high as expected. No student underestimated by three or more points. Only 15 students underestimated by two points. Of those 15 students, eight were men (five older and three younger) and seven were women (five older and two younger). The researcher had assumed,
based on experience in the classroom, that more women would underestimate. It is possible that this belief is based on the anecdotal evidence of student comments and conversations about presentations. Women “in general, are taught that it is more acceptable to verbalize their feelings, portray vulnerability, express humility, or downplay their own competence” (Blanch et al., 2008, p. 378). As a result, the researcher may have just been hearing from the women more often, even when men were also underestimating themselves.

The fifth objective of this study was to determine if the variables of sex and age significantly influenced students’ self-assessed presentation confidence ratings. The findings indicate that sex and age did not influence the confidence ratings. The researcher had assumed based on the research and her own experiences that sex and age would influence the confidence ratings. The findings, while unexpected, encourage the researcher to challenge her own preconceived notions and continue to use analysis to improve her understanding of her students.

**Research Question 5 Recommendations**

Based on the findings for research question five about the influence of sex and age on students self-reported confidence ratings, the following recommendations are provided for both the researcher (SoTL Recommendations section) and other PSM practitioners and policy makers (Practice and Policy Recommendations section).

**SoTL Recommendations.** The SoTL recommendations for research question five are divided into two categories: continue and expand. First, the researcher should continue to collect data and analyze the findings following the methodology indicated in chapter three for a deeper understanding of the role of sex and age in confidence ratings. The goal of the continued analysis is to influence the researcher’s understanding of her students’ confidence with presentation skills in order to better serve them and support their learning. Not only will additional participants
provide a more robust picture of the students’ confidence, but the researcher will be able to track trends and adjust to findings.

Second, the researcher should expand her analysis of both the confidence ratings and of her own teaching. By expanding the way that the confidence rating data is analyzed, more information could be gleaned. The expansion could include looking at the significance of the magnitude of the overestimation or underestimation in terms of sex and age. In addition, the researcher should incorporate more analysis of her own rating practices to check for interactions.

Although not an originally intended part of the study, while running regressions on the points of collection of confidence, a regression was also run on the instructors’ competence ratings to check for influence of sex and age. The results were similar to the confidence ratings: the variables of sex and age did not influence the instructors’ competence ratings. Sellnow and Treinen (2004) also found that ratings of speaker competence were not affected by the speaker sex. The researcher is pleased with this serendipitous finding that her ratings and the ratings of the other two instructors were not influenced by the students’ sex or age. The researcher can commit to using statistical analysis on her rating and feedback of students to ensure that she maintains a fair rating system that is not influenced by the sex and age of her students.

**Practice and Policy Recommendations.** Two recommendations for practice and policy for all PSM programs came from the findings for research question five. First, the researcher recommends that all PSM instructors should implement analysis of their own feedback or rating in order to check for interactions of sex and age. Second, PSM institutions could make the analysis of feedback part of the assessment of PLUS courses and implement the analysis as a best practice.
All SoTL and Practice and Policy Recommendations

In the sections above, the researcher provided recommendations for both SoTL and practice and policy for each of the five research questions. In this section, all the SoTL recommendations and the practice and policy recommendations are combined in order to see them at one time.

The researcher should

- continue to collect confidence and competence ratings with future classes of students
- continue to analyze student confidence ratings and instructor competence ratings and incorporate the use of an interactive dashboard
- expand the number of times the confidence pie chart is shared
- change the information provided on the Likert-scale for collecting confidence ratings from the students by labeling each number on the scale
- continue to use multiple instructors to establish competence ratings
- expand what students receive in terms of feedback by sharing competence ratings
- expand the use of video to support students’ understanding of their presentation skills
- expand the use of the want/need matrix for presentation skills
- expand the CTW to include specific training in self-assessment of presentation competence
- expand her analysis of both the confidence ratings and of her own teaching

PSM programs should

- include opportunities to self-assess confidence in the many soft skills areas that are covered in PSM PLUS courses
• ensure that PLUS courses in communication provide appropriate individualized feedback for presentation skills
• examine rating and feedback practices in PSM PLUS courses
• incorporate an analysis of students’ soft skills confidence ratings and competence ratings and use an interactive dashboard to visualize the data
• implement a module that supports students’ ability to self-assess and seek and accept feedback
• analyze feedback practices in order to check for interactions of sex and age
• make the analysis of feedback part of the assessment of PLUS courses and implement the analysis as a best practice

It is the hope of the researcher that these recommendations can be implemented to improve her own communication courses and other PSM PLUS communication courses. Some of these recommendations are more complex than others (such as creating a module to support self-assessment and metacognition); however, many of the recommendations would require little effort on the part of the instructor and could still create positive outcomes.

Limitations

Three limitations must be discussed in order to understand the constraints on this study and potential future research that could address some of the concerns. The first limitation is the study population, the second limitation is the use of self-assessed Likert-scale data, and the third limitation is the number of variables in the study.

The population for this study is special, and the findings are not generalizable to all graduate students or even all PSM graduate students. The population in this study is relatively balanced in terms of sex (men = 57.21% and women = 42.79%). Note that this study used
biological sex or sex assigned at birth, and not gender or gender expression, because that was the way that the data was collected at the time of student application. Not all analytics programs accept or enroll as many women (Rappa, 2019). In addition, although students do not know the full extent of the presentation training and delivering that is required during the program, there is an expectation of at least some presentation skills needed. The typical jobs for the PSM graduates from this study require communication skills, so the students applying for this PSM program are already different from the general PSM graduate population. This particular PSM may shape the kinds of students who apply because “people self-assess their relative ability when making career choices. Thus, confidence in their own abilities is likely an important factor for selection into various career paths” (Schulz & Thöni, 2016, p.1). The specialized nature of the PSM program limits the ability to make overarching statements about confidence and competence with presentation skills for all PSM programs.

In addition, although having 215 participants in an educational study is a robust number, 15 members of the population were removed before analysis because of missing values. Those 15 students may have had an influence on the results. As noted in chapter four, the reasons for missing values included illness as well as unexcused reasons, such as not completing the reflection exercises. Some of those not completing the assignment were also poor performers and their ratings certainly influenced the researchers’ beliefs about confidence and competence. However, without their ratings in the analysis, the most complete picture of the population was not achieved.

A second limitation is the use of self-assessed Likert-scale data. Although Likert scales are very common in educational research (Norman, 2010), some inherent limitations exist. First, students may not be interpreting the scale the same way. A rating of three may be considered
average to one rater and may be below average for another. Even labeling each number on the scale still leaves room for different interpretations. The “differential use of the scale among students” (Ward et al., 2002) is a limitation that is pervasive, not just an issue for this study. Another concern for the interpretation of the Likert data is that using expert judgement, or what Ward et al., (2002) called the gold standard, can be problematic. Certainly, having only one expert judge could be a serious problem. This study used three expert judges to determine the Likert scale data for the concept of competence. Even with three judges, who came to consensus on the ratings of competence, issues can exist. Just like the students’ differential use of the scale among other students, the three instructors and the students may not have used the scale the same way. Lastly, the honesty of the students’ rating is a limitation of any self-assessment including Likert-scale data. There are numerous reasons that the self-reported data may not be accurate. Students may choose to overrepresent or underrepresent their ratings for a variety of reasons including modesty and humility (Blanch et al., 2008), culture (Heine, Markus, Lehman, & Kitayana, 1999), and incentives (Bolívar-Cruz & Verano-Tacoronte, 2018).

The third limitation of this study is that it looked at only two variables to determine if they influenced students’ confidence ratings. Although limited, the choice of the two variables of sex and age was intentional. This study was inspired by Kruger and Dunning’s findings in their 1999 study that indicated that gender did not influence overestimation or underestimation. Because of that, only two variables were used in this study—sex and age. Age was selected specifically to determine if older or younger men and women rated themselves differently on the confidence scale. Additional variables could provide a different picture of PSM students’ confidence and competence. However, that was outside the scope of this study. In the next
Recommendations for Future Research

Although this study provided important information about confidence and competence about PSM students’ presentation skills, it is just the beginning. This study can serve as the basis for expanded future research at the study’s PSM program and also for PSM PLUS courses across the nation. Developing competent communication skills is one of the foundations of the PSM curriculum’s PLUS courses. According to Harkins and Strausbaugh’s (2017) report, communication courses are the most frequently taught PLUS course. The existing research about PSMs is small but growing, and the following five suggestions could contribute research and best practices of PLUS courses for all PSM programs.

Future Research: Incorporate Mixed Methods

The first and most obvious suggestion is to expand this quantitative study by incorporating qualitative research in order to take a mixed methods approach. In addition to collecting the confidence and competence ratings, interviews and written reflection responses could be collected and analyzed. Specifically, student writing about their own attitudes about presentation skills and their own perceptions of their confidence with presentation skills would provide “rich, thick descriptions” (Merriam & Tisdell, 2016) that are not captured in the strictly quantitative data of this current study. The possibilities for incorporating a qualitative aspect to this research are numerous. A phenomenological approach could focus on the lived experience (Groenewald, 2004) of a PSM student learning presentation skills and self-assessment skills. A grounded theory approach could attempt to explain why PSM students overestimate or underestimate. A case study of a small group of PSM students could reveal patterns of
similarities and differences in self-assessment and confidence. This study’s quantitative approach was appropriate at this time for discovering the students’ confidence ratings and comparing them to the instructors’ competence ratings. Because of the nature of the accelerated PSM program, adding additional elements like interviews or written reflection responses that were not already part of the PSM program could put an unnecessary burden on the already busy students. This burden could limit the number of participants if students (rightfully) chose to prioritize schoolwork over completing interviews or additional writing for a research study. By applying quantitative analysis to existing ungraded assignment data, students were not inconvenienced, and the study was able to maintain a large number of participants.

**Future Research: Add More Participants**

Although the study was able to analyze data from 215 participants out of a possible 230, increasing the number of participants could reveal more information and possible patterns. Collecting and analyzing the confidence and competence data should continue with future classes. This continual analysis can also be helpful for instructors, especially any new instructors who may be brought in, to ensure that they continue to rate students without being influenced by sex or age.

In addition, future research could include other PSM programs. With over 345 recognized PSM programs as of 2018 ("Professional science master’s,” 2020), future research could include two kinds of partnering with other PSM programs. The first research partnership could be with other PSM programs at the same university. Examining the confidence and competence in presentation skills of graduate students at the same university but in different PSM programs could provide insight into soft skills PLUS offerings. The second kind of research partnership could be with similar PSM analytics programs at other universities. Again, this research could
inform decisions about PSM PLUS offerings. This kind of future research may be of special interest to the National Professional Science Master’s Association (NPSMA).

**Future Research: Include Other Measurement Scales for Confidence**

This study used a Likert-scale question to identify students’ presentation confidence. Future research could go deeper into the topic of confidence and examine if students’ presentation confidence has any relation to their overall communication confidence. The general confidence scales for communication that are listed in chapter three, Self-Perceived Communication Competence Scale (SPCC), Personal Report of Communication Apprehension (PRCA-24), Personal Report of Public Speaking Anxiety (PRPSA), and Willingness to Communicate (WTC), could be used. Another possibility is to consider a general confidence scale, such as the one created by Richard Petty and Kenneth DeMarree for Kay and Shipman’s (2014) book, *The Confidence Code*. Emotional Intelligence (EQi-2.0) could also be used as a generalized scale to analyze students’ ratings of their presentation confidence. These additional measures of confidence could add depth to the understanding of students’ feelings of confidence with their presentation skills.

**Future Research: Add Additional Variables**

Future research could include many other variables to determine if any of them influence confidence ratings. The following list provides suggestions for additional variables to be included in future research about confidence with presentation: years of job experience, prior presentation experience, prior presentation training, extracurricular activities, emotional intelligence, MBTI personality types, undergraduate and graduate GPA, attitude toward soft skills, and peer feedback ratings. Even considering the undergraduate major of the participants could reveal relevant information. For instance, Karatjas and Webb, (2017) found differences in
being able to predict performance between science majors. Future studies of PSM students’ confidence with their presentation skills should include more variables.

**Future Research: Incorporate Student Input**

Incorporating more student input in the research as suggested by SoTL best practices could provide additional insights. Although the students in this study were aware that their entire experience at the program was the subject of analysis because of the nature of the degree program in analytics, the students could be more involved in future studies. Students could suggest more variables or execute different analyses on the data. By working with the data to produce dashboards or other visualizations, students may be able to better understand their own strengths and areas for improvement with presentation skills.

**Conclusion**

As PSM programs work to develop and hone PLUS courses that serve the needs of the graduate students during their studies as well as in their future careers, examining students’ confidence and competence has been revealing. Accurate self-perception is important in developing communication skills “because self-perceptions can influence one’s performance” (Peterson et al., 2014, p. 328). As Dunning (2005) indicates, “people need to know what their strengths are... They need to be aware of their weaknesses so that they can improve upon them” (p. 2). The study has unveiled important information for the researcher and for the PSM program about confidence and competence with presentation skills. Not only has this study helped to shape the researcher’s ideas about teaching presentation skills, but this study has the potential to influence other PSM programs and instructors.
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APPENDIX: IRB APPROVAL
Dear Sarah Egan Warren:

IRB Protocol 20419 has been approved

Title: Professional Science Master's Students' Confidence and Competence with Presentation Skills

PI: Bartlett, Michelle E

The project listed above has been reviewed by the NC State Institutional Review Board for the Use of Human Subjects in Research. This project was reviewed via Expedited procedures under Expedited 5.

NOTE:
1. This board complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU the Assurance Number is: FWA00003429.
2. You must use the approved consent forms which are listed as “approved” in the eIRB protocol.
3. Approval for this study does not expire.
4. Any changes to the protocol and supporting documents must be submitted and approved by the IRB prior to implementation.
5. If any unanticipated problems or adverse events occur, they must be reported to the IRB office within 5 business days by completing and submitting the unanticipated problem form on the IRB website: https://research.ncsu.edu/sparcs/compliance/irb/submission-guidance/.
6. Any unapproved departure from your approved IRB protocol results in non-compliance. Please find information regarding how to avoid non-compliance on our website.

If you have any questions, please don't hesitate to contact us.

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NCSU IRB Office