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Professional Competency Self-Efficacy of Undergraduate Environmental Studies Students: A Case Study of Gender Differences and Longitudinal Change

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ABSTRACT: Business leaders and political leaders have asked institutions of higher education to improve graduates' cognitive and affective skills, sometimes referred to as "soft skills", personal competencies, professional competencies, "21st century skills" or 21st century competencies. As a result of their importance, demands for these skills in the workforce, and increased pressure to be accountable, higher education is challenged to assess student achievement and performance related to these competencies. The goal of this paper is to investigate the longitudinal changes in relative self-efficacy of undergraduate environmental students across three domains of professional competencies – cognitive, intrapersonal and interpersonal. More specifically, the objectives are to: 1. Examine the extent to which there are differences in self-efficacy for male and female students in an environmental studies program; 2. Assess the extent to which self-efficacy of the environmental studies students change over the time they are involved in the undergraduate program and their relationship to learning outcomes.

An examination of pre-program self-efficacy data indicate statistical differences between males and females that are consistent with social role theory that posits that gender traits are developed as a result of the differential roles that women and men occupy in society. The observed statistical differences between males and females based on effect size are generally maintained between pre- and post-program data for the unpaired data. However, differences in the effect size of five competencies between pre- and post-data suggest that the impact of the educational experiences for male and female students is different.

A comparison of the pre- and post-scores for paired female data indicate that overall female self-efficacy showed a general increase for 18 of 23 competencies. Statistically significant increases in female-student confidence in their abilities occurred in continuous learning, employee development, presenting, diplomacy, and written communication. Paired pre-post male data indicate that overall male self-efficacy for 19 of 23 competencies increased. Statistically significant increases in male-student self-efficacy occurred in employee development/coaching and diplomacy. Increases in self-efficacy data supports the contention that development of 21st century competencies is occurring as the students actively engage in activities where they can practice these skills.

KEY WORDS: Assessment, Professional Competencies, soft skills, 21st century skills, Self-Efficacy, Effect Size, Gender Differences

INTRODUCTION

The success of students who graduate from an institution of higher education, whether they go into the workforce or continue their education, is a function of the extent to which they have acquired various skill sets. One set of skills for which business leaders and political leaders have asked institutions of higher education to improve in their graduates are a broad set of cognitive and affective skills. These skills referred to as "soft skills", personal competencies, professional competencies, "21st century skills" or 21st century competencies (NRC 2012; Partnership for 21st Century Skills, 2009). Robles (2012, p. 457) described these skills/competencies as "character traits, attitudes, and behaviors—rather than technical aptitudes or knowledge." These skills include among others, the abilities to innovate, create, solve complex problems, think critically about tasks, effectively communicate with diverse audiences from diverse backgrounds, collaborate with others, adapt to dynamically changing work environments, and continuously learn. These skills/competencies are broadly applicable and transferable across all professions to varying degrees. They are foundational to a person's abilities to effectively use their intellectual and technical skills. These

attributes help workers adapt to new jobs, overcome obstacles, develop productive relationships internally and externally to the organization, and overall thrive in the workplace.

The extent to which a person can successfully employ professional competencies is related to a person's self-efficacy. A person's self-efficacy, sometimes referred to as confidence, is their belief in their "capabilities to mobilize the motivation, cognitive resources and courses of action needed to meet given situational demands" (Wood and Bandura 1989). Self-efficacy does differ from mere confidence as it emphasizes taking a course of action rather than simply holding an opinion or belief (Woolcock et al 2016). The extent to which a student believes they have the capabilities to accomplish a task or use a skill plays an essential role in determining their level of success (Zimmerman 2000).

The goal of this paper is to investigate the relative self-efficacy of undergraduate environmental students across three domains of professional competencies – cognitive, intrapersonal and interpersonal. More specifically, the three main objectives are: 1. Examine the extent to which there are relative differences in self-efficacy for male and female students in an environmental studies program; 2. Assess the extent to which self-efficacy of the environmental studies students change over the time they are involved in the undergraduate program; and 3. Evaluate these data in the context of program learning outcomes.

BACKGROUND

Institutional Setting and Program Overview: The Environmental Studies Program at the University of Nebraska – Lincoln, which is a Land Grant Institution and Carnegie-classified research university with very high research activity and high undergraduate enrollment, is jointly owned and operated by the College of Arts and Sciences (CAS) and the College of Agricultural Sciences and Natural Resources (CASNR). To graduate from the Environmental Studies program, students take 120 student credit hours (SCH) that include 13 SCH in six core courses in Environmental Studies (ENVR). Table 1 provides the program goals and learning outcomes for the program. If these overarching outcomes are achieved, program graduates will be: conversant in the issues and demands of global society; prepared to meet the needs of employers who want employees that possess relevant workforce competencies; and able to work across disciplines.

In the core curriculum, students have multiple opportunities to address the program's learning outcomes (Table 2). They practice critical thinking and problem-solving to develop creative solutions for complex environmental challenges with a specific emphasis on sustainability solutions. To facilitate the development of professional competencies and systems thinking, pedagogical approaches, and high-impact educational practices are used that promote student independence, self-directed learning, and self-reliance. More specifically, the Environmental Studies program incorporates all six high impact practices identified by the National Survey of Student Engagement as important, either directly (Service-Learning, Research with Faculty, Internship/Field Experience, Culminating Senior Experience) or indirectly (Study Abroad, Learning Community), into its students' undergraduate experience. During their culminating two-semester senior thesis capstone sequence of ENVR 499a and b, each student uses critical thinking and problem-solving skills, employs writing and presentation skills, and practices professional skills to generate a creative or scholarly product, referred to as a senior thesis.

The program also requires a set of collateral courses that includes instruction in Earth systems including climate, ecology, Earth and energy resources, soil resources, and water resources; geospatial science including GIS, GPS, and/or remote sensing; statistics; and human dimensions including sociology, anthropology, ethics and law, resource management and leadership, economics, and policy. These collateral courses provide Environmental Studies students the opportunity to follow developmental pathways towards becoming a professional who understands the language of other disciplines and has learned to interact effectively and creatively with those in other fields. Soule and Press (1998) refer to this as students becoming "inter-disciplinarians."

Table 1. Program goals and learning Outcomes for the Environmental Studies Program at the University of Nebraska-Lincoln.

Program Goals
Upon graduation, students will
Goal 1. possess the necessary knowledge and skills to be successful in the job market, the pursuit of a graduate degree, and working across disciplines.
Goal 2. have broad-based knowledge in the natural sciences, social sciences and the humanities as well as strength in a specific discipline.
Goal 3. make reasoned and informed judgments about contemporary environmental issues from an interdisciplinary perspective using sustainability as framework to connect humans to the living and physical environment.

Learning Outcomes

L.O. 1. Explain and apply appropriately the systemic principle of sustainability for the development of solutions to environmental and natural resource issues.

L.O. 2. Organize, plan, and satisfactorily complete a senior project through scholarly creativity and/or in-depth research that uses appropriate technical knowledge, field, laboratory, geospatial, and/or social science research methodologies.

L.O. 3. Demonstrate the ability to critically assess environmental and sustainability issues from the local to global scale considering a range of perspectives.

L.O. 4. Identify, explain, and evaluate problems/questions/issues using relevant data, resources, and reasoning to form carefully considered conclusions.

L.O. 5. Communicate effectively to a range of audiences through the preparation of written documents along with oral and visual presentations that are consistent with professional standards.

L.O. 6. Describe the Earth's four major spheres: land, water, living things, and air in the context of physical, geological, and biological processes; their variability over space and time; and the extent to which humans influence them.

L.O. 7. Effectively work in teams and groups from various backgrounds and perspectives to address environmental challenges.

L.O. 8. Demonstrate improvement in professional and interpersonal skills such as collaboration, critical thinking, problem solving, empathy, and teamwork to effectively operate in society and the professional world.

Table 2. Summary of Environmental Studies courses (ENVR), credit hours, and learning outcome

Course	Credit Hours	Learning Outcome
ENVR 101 Environmental Studies Orientation	1	5,6,7
ENVR 201 Science, Systems, Sustainability and the Environment	3	1,5,6,7,8
ENVR 249 Individual and Cultural Perspectives of the Environment	3	2,6,7,8
ENVR 319 Environmental Engagement in the Community	2	4,5,6,7,8
ENVR 497 Internship in Environmental Studies	1	3,4,8
ENVR 499 Senior Thesis	3	3,4,5,8

Professional Competencies: The term competency, as used by the National Research Council (NRC 2012), and throughout the remainder of this paper, is consistent with its use in the professional human resources literature. The term is a way of talking about what helps people get results in their jobs and referencing skills or knowledge that lead to superior performance. Competencies are measurable characteristics that are used to differentiate levels of performance in a given job, role, or organization.

The National Research Council (NRC, 2012) developed a classification scheme for professional competencies consisting of three broad, but overlapping, clusters that include cognitive, intrapersonal, and interpersonal domains. The cognitive domain involves reasoning and memory; the intrapersonal domain involves the capacity to manage one's behavior and emotions to achieve one's goals; and the interpersonal domain involves expressing ideas, and interpreting and responding to messages from others (NRC 2012). Research on teaching and learning has illuminated the importance of cognitive and affective competencies on learning of academic content (e.g., NRC, 2000) and how to develop these valuable supporting skills (e.g., Yeager and Walton, 2011). Research indicates that young people who apply and develop intertwined cognitive intrapersonal, and interpersonal competencies in the process of deeper learning are better prepared for adult success (NRC 2012). A primary product of deeper learning is the ability to know how, why, and when to use and transfer knowledge that includes content knowledge to answer questions and solve problems.

The NRC (2012) emphasized the importance giving young people the opportunity to apply and develop their cognitive, intrapersonal, and interpersonal competencies as part of the process of deeper learning that, in turn, better prepares them for success in the workforce. The use of the term "soft skills" for these competencies is really a misnomer in that in many ways they are more difficult to acquire than knowledge and technical skills. These competencies are not fixed. They are developed through years of practice.

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Researchers have identified a variety of competencies that should be incorporated into learning goals for students when training them to productively contribute to interdisciplinary and transdisciplinary team research and workforce efforts (NRC 2015). Vincent and Focht (2010) indicate that employers of graduates from environmental programs highly value skills related to interdisciplinary teamwork, critical thinking, problem solving, communication, planning, and management. From their analysis, these skills "may actually be more important than substantive knowledge, though knowledge of environmentally relevant natural sciences and sociopolitical disciplines are undoubtedly important." Crawford et al. (2011) indicated that 21st century competencies, for which they use the term "soft skills," are ranked as being more important than discipline knowledge among alumni and employers. Weik (2011, 2015) identified inter- and intrapersonal competencies as critical for sustainability professionals. Boone et al. (2020) indicate the importance of professional competencies such as collaborative leadership, vision beyond status quo (i.e., futuristic thinking), communication to multiple audiences, and perseverance to participants in interdisciplinary and transdisciplinary projects.

As a result of their importance, demands for these skills in the workforce, and increased pressure to be accountable, higher education is challenged to assess student achievement and performance related to these competencies. Higher education finds itself in a modern business world that follows the basic premise of Peter Drucker, to whom modern business management is attributed, that is "If you can't measure it, you can't improve it." Becker et al. (2017) report that as a result of growing trend in higher education to measure learning and competency, a wide variety of methods and tools are being examined as to evaluate and measure learning progress, skill acquisition, and other educational needs of students. These authors indicate that societal and economic factors will continue to redefine what skills are necessary for success in today's workforce. As a consequence, higher education must rethink how to define, measure, and demonstrate not only subject mastery, but the acquisition of professional competencies.

The development of assessments for professional competencies is complex and challenging on a number of levels (Shavelson 2010; NRC 2011; Lai and Vering 2012). For example, the multiplicity of names for interpersonal skills leads to complications in defining the construct, that is, the type of knowledge, skill or ability that an assessment is designed to measure (Fiori, noted in Koenig et al. 2011). Shavelson (2010) illustrated that measuring competency constructs needs to involve observations of tasks using standards of performance, standardized across individuals consistent with the "real-life" domain of knowledge, social expectations and interactions, and realistic time frames during which the competency will be performed.

Because of the complexity of assessment development and implementation, the tools necessary to assess the extent of skill/competency acquisition are not necessarily in a format that meet the criteria that higher education use to select assessments (Klein et al, 2006). These criteria include, but are not limited to, cost and ease of administration, alignment of the assessment with the educational outcomes of the institution/academic unit, the technical qualities of the assessment, the expertise to prepare assessments, or the time and expertise to analyze and use these data.

As is the case with many academic programs, especially small ones, the UNL Environmental Studies program is limited in terms of its capabilities to assess these professional competencies. The program has used an action research approach to our assessment activities in which we use reflective practice to gain insight into student learning experiences. To help us reflect on the abilities of our students to acquire relevant professional competencies, a partnership with TTI Success Insights (TTISI was forged and their Personal Soft Skills Indicator™ questionnaire described below) employed to document the self-efficacy of UNL's Environmental Studies students as a proxy for the extent to which students have acquired professional competencies.

Self-Efficacy: Self-efficacy "is defined as one's perception of his/her ability (i.e., confidence) to successfully perform a task or behavior" (McCoach et al. 2013 simplified from Bandura 1986). A person's ability to perform skills to achieve certain tasks depends largely on their judgment as to how well they expect or anticipate to perform. The extent to which a student believes in their academic capabilities is a key motivational factor related to student performance. In essence, if an individual's expectations that they can perform certain skills are positive, this positively contributes to the actual physical, social or self-evaluative outcomes (Bandura 2006). Zimmerman (2000) noted that self-efficacy beliefs play an important role in mediating students' performance and academic achievement. Academic self-efficacy is a reliable predictor of student achievement (Richardson et al 2012). Huang (2013) documents that students with high self-efficacy perform better than those with low self-efficacy because they typically take mastery approach to setting goals (Huang, 2013). Individuals with high self-efficacy not only put more effort into their learning (Galla et al., 2014), but are also more persistent when confronted with adversity (Zeldin and Pajares, 2000). Students, who have high self-efficacy, choose tasks that are hard and challenging to comprehend and also try as much as possible to employ actions to achieve learning goals more than those with low self-efficacy (Augistiani et al. 2017). The basic premise of our approach is that self-efficacy is a first-order proxy for the extent to which someone has obtained a given competency.

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The development of a person's self-efficacy related to a specific competency is the result of a complex interplay of experiences that Bandura (1986) placed into four categories. These are mastery experiences, vicarious experiences, social persuasion and people's own physiological states in estimating their capabilities. According to social cognitive theory (Bandura, 1997), there should be gender differences in confidence and related self-beliefs. The development of self-efficacy in females is influenced more strongly by vicarious experiences and social persuasions while mastery experiences are a more significant source of self-efficacy in men (Espinosa et al., 2019, and references, there in). It is well established that self-efficacy is correlated with academic achievement, task persistence, motivation, and resilience (e.g., Bandura, 1986; Pajares, 1996; Komarraju and Nadler, 2013). Papyrina et al. 2020 reported that female students have higher self-efficacy than male students in interpersonal skills, friendly/outgoing personality and organizational ability. On the other hand, male students have higher self-perception of competence in problem-solving, analytical/ quantitative, technical and computer skills. No gender differences in confidence were found in leadership, initiative, strategic planning and entrepreneurial skills. In a study of biology students, Ainscough et al. (2016) indicated that overall female students were significantly less confident than males. Moreover, high-achieving female students were more likely than males to underestimate their academic abilities.

According to social role theory (SRT), a person's perception and self-concept (i.e., self-efficacy) of themselves are in large part gender-stereotypical (Eagly and Wood, 2012). SRT posits that gender-related traits and roles originated historically because of inherent biological differences - men's strength led to their roles as hunter, farmer, worker, and eventually, leader. Women reared children and maintained home life. Because of these different roles, women generally developed more communal traits whereas men have more agentic traits. Communal traits are orientated towards participation of the individual as part of an organization and agentic traits are focused on the existence of the individual (Abele 2014). Communal traits include nurturing, empathy, kindness, openness, compassion, sensitivity, etc. These are consistent with successful caring for others. Agentic traits include aggressiveness, competitiveness, achievement- orientation, individualism, and determination consistent with the male role as hunter, farmer, worker, and eventually, leader. These traits as men and women are reinforced by the process of socialization that creates behaviors traditionally associated with their sex (Eagly and Wood, 2012).

The goal of this study is to ***i***nvestigate the relative self-efficacy of undergraduate environmental students across three domains of professional competencies – cognitive, intrapersonal and interpersonal. More specifically, the objectives are to: 1. Examine the extent to which there are differences in self-efficacy for male and female students in an environmental studies program; 2. Assess the extent to which self-efficacy of the environmental studies students change over the time they are involved in the undergraduate program and their relationship to learning outcomes.

METHODS

Procedures: The UNL-Environmental Studies program uses TTISI's TriMetrix® DNA instrument to assess the personal attributes of the students using self-report data (Gosselin et al. 2013. The first two parts of the instrument assesses the behavioral characteristics and motivational drivers for the student. The third part, which is the focus of this paper, uses the Personal Soft Skills Indicator™ (PSSI) questionnaire to document the self-efficacy to which people feel they have acquired specific personal competencies. The PSSI construct is consistent with the description of other instruments that assess self-efficacy (Bandura 1997, 2006). Self-efficacy scales typically measure people's beliefs in their capabilities to fulfill different levels of specific demands of a task. The PSSI assesses 23 competencies that are summarized and categorized in Table 3 using the three domains defined by the National Academy of Sciences (NRC, 2012).

The PSSI is an online instrument that consists of three sections and takes approximately 30 to 45 minutes for the students to complete on their own time. The first section is a dichotomous selector (checkbox) asking the respondent to associate with as many or as few of the items related to the various competencies as he or she wishes. The second section is in Likert format, consisting of 42 items related to the extent to which the respondent thinks of him/herself. The third section has 50 items using a Likert scale to assess the extent to which the respondent perceives he or she is viewed by others.

The goal of the Environmental Studies program is to acquire longitudinal data on UNL environmental students. The pre-program assessment is completed as part of a one credit, one semester orientation course (ENVR 101). The report students receive provides information that helps them understand their own strengths and personal attributes. In essence, they improve their knowledge of self. As part of the senior capstone course, ENVR499, each student takes the assessment again. These data are referred to as post-program. Participation in these assessment activities is part of their regular course activities; however participation in the research component is voluntary and students can opt out if they desire at any time.

Validity and Reliability: Established in 1984, TTI Success Insight's assessments have been translated into 40 languages and are used in 90 countries. Bonnstetter and colleagues have administered over 10 thousand TriMetrix DNA assessments related to engineering and medical education (e.g., Bell et al., 2011, 2012; Pistrui et al. 2011, 2013). As part of this work, Dietrich (2012) examined the internal consistency of the 23 competencies and found the Cronbach's Alpha to generally exceed 0.80. TTI conducts 360-degree feedback surveys to assess the perception of others on an individual's evidence-based competencies. Feedback from 7000 surveys indicates that each question in the survey captures the range of responses from the minimum to the maximum choice, which supports the validity of individual questions (TTISI 2013).

As is the case with any self-report instrument, there are several biases that can influence the self-report measures. Gosselin et al. (2103) provides an overview of the biases as summarized from Bedwell et al. (2011). They indicate that consistency motif and self-serving bias may contribute to the scores overestimating the student's abilities to some extent; however, these biases become minimized when comparing pre- and post-program data as it is change, not absolute score characteristics, that are being evaluated. Self-reports have limitations, but they are outweighed by the benefits to the program that include a better understanding of where students are starting from in terms of their self-efficacy and the extent to which the students have grown throughout their undergraduate experience.

Data Sets: In this paper, two data sets were used (Table 4). Data set 1 includes data for male and female students who completed the PSSI assessment from Spring 2009 to Spring 2019 either pre and/or post-program. These data in set 1 are unpaired and examine the differences between male and females. Data set 2 is a subset of data set 1. It includes only data from students who completed the assessments both pre- and post-program. These data assess longitudinal changes from when students entered the program through the orientation course (pre-program) and completed their senior thesis (post-program). The maximum score for each of the 23 competencies using the PSSI instrument is 10.

Table 4. Number of respondents to PSSI survey.

Data Set 1: Unpaired	**Pre**	**Post**	**Total**
Males	97	132	229
Females	103	124	227
Data Set 2: Paired			
Males	79	79	186
Females	107	107	

Statistics and Data Analysis: Although the Shapiro-Wilk (SW) test indicated that these data for individual competencies generally followed normal distributions, some did not. For the sake of completeness results from both parametric and non-parametric tests were chosen to examine differences between the pre- and post-program samples groups. The non-parametric tests are valid over a broader range of situations in that they do not require specific assumptions of normality to be met. For a comparison of means, Welch's T-test were used for the unpaired and paired data, respectively. A non-parametric comparison of the unpaired pre- and posted data were assessed using the Mann-Whitney U test and the Wilcoxon-Sign Ranked Test, respectively. The null hypothesis for these tests is basically that the two samples come from the same population (unpaired) or whether observations post-program tend to be larger than pre-program observations (paired). These tests for statistical significance and their associated p-values tell the reader that the difference found between groups is unlikely to be caused purely by chance. The outcomes are a function of sample size and do not say anything about the magnitude or practical relevance of a result. p-values <0.05 are considered to be statistically significant. p-values between 0.5 and 0.10 are referred to as marginally significant.

As recommended by the American Psychological Association, effect sizes are provided to provide a quantitative measure of the magnitude of the interventions effect (Fritz et al. 2012). In this case, the intervention is the educational experience that the student received during the pre- and post-program assessment or the extent to which a characteristic such as gender differences have an effect. The effect size provides a measure of "the size of the effect" from the intervention rather than pure statistical significance. Effect sizes indicates the average change in scores in the context of standard deviations. For example, an effect size of 0.20 indicates that an instructional intervention increased students' scores by 0.20 standard deviations. Two effect size calculation are provided. See Table 5 for details of calculations used. The effect size referred to throughout the remainder of the paper will be Cohen's D.

For the paired data, the effect size is computed as the difference between the means for the same student tested pre- and post-program. They thus estimate the average change in student self-efficacy from pre- to post-program. The unpaired data provides an overall comparison of the self-efficacy characteristics of the males and females entering the program versus when they graduate from the program. The full representation of the intervention effect, therefore, is not simply the difference between the males and females as an outcome measure at post-program, but the differential change between pre-program and post-program on that outcome. The measure of the differential change is provided as the adjusted effect size in the last column of the unpaired data table. By showing effects as differential change, the approach reveals patterns of improvement or decline that characterize the two groups as a whole (Durlak 2009; Lipsey et al. 2012). Different patterns of differential pre-post change depict different trajectories for what the intervention accomplished.

RESULTS

Data Set 1 – Unpaired data: Table 5 provides the mean scores from males and females, mean difference, Wilcoxon Ranks Sum variables, Welch's T-test p-values and effect size (Cohen's D) for the unpaired data. These data are used to collectively examine similarities and differences between males and females. Among the five cognitive scales, females had statistically significant higher planning and organizing scores than males along with an effect size of 0.30. Whereas, males had significantly higher scores for decision-making and an effect size of 0.52. For the intrapersonal scales, males were significantly more confident in their personal effectiveness than the females with an effect size of 0.57. For the 13 interpersonal competencies, females had significantly higher scores for four competencies (employee development/coaching, diplomacy, customer service, and empathy) for which the effect sizes were 0.26, 0.25, 0.27, and 0.41 respectively. Males had statistically higher scores for two interpersonal competencies – management and negotiation having effect sizes of 0.48 and 0.47, respectively. Persuasion was marginally significant for males having higher scores than females and an effect size of 0.23.

The noted differences between males and females in the pre-unpaired data maintain themselves in the post, unpaired data. However, males become more confident in their abilities to manage conflict, self-manage, and persuade others when compared to females having effect sizes of 0.37, 0.31, and 0.33. Females become more confident with respect to their written communication abilities than males that are reflected in their effect sizes of 0.36.

The adjusted effect sizes reflect the extent to which there has been a differential change between two groups over time (Durlak 2009). An adjusted effect size value close to zero indicates that the differences between male and female have maintained themselves after the educational intervention. Positive adjusted effect scores indicate that the differential change favored female students. Negative adjusted effect scores indicate that the differential change favored male students. Of the seven competencies that showed an adjusted effect over 0.20 standard deviations, the three that favored females (creativity/innovation, management, personal effectiveness) are the competencies for which the average scores of the males dropped by 0.1 to 0.3 points, while the average female scores increased by 0.1 points. For the other four competencies (self-management, interpersonal skills, customer service, and conflict), the adjusted scores coincide with 0.3 to 0.8 point increases in average scores for the males while the corresponding female scores dropped by 0.1 points or increased marginally by 0.1 units.

There are eight other competencies that have adjusted effect scores between 0.1and 0.15 standard deviations. Six (presenting, persuasion, analytical problem solving, continuous learning, flexibility, and leadership) have greater differential change in the scores of males relative to females. The differential changes are reflected in the greater positive change in average scores from pre to post for the males (0.2 to 0.7) when compared to females (-0.1 to +0.4). Differential effects in written communication and goal orientation favored the female students. Average change in scores for written communication indicated an increase of 0.6 points for females compared to a corresponding increase for males of 0.3 points. For goal-orientation, male average scores dropped by 0.1 unit while females increased by 0.2 units.

Data Set 2– Paired data: Table 6 provides paired pre- and post-data for all male and female combined (n = 186), female only (n = 107) and male only (n = 79). These samples are a subset of data set 1 in which each student has a matched set of values for pre- and post-program data. The purpose of these data is to more specifically examine the magnitude of the changes that have occurred for the entire group and by gender. These data include mean scores, standard deviations, mean difference, Wilcoxan ranks statistics, p-values, Student's T-test for matched pairs and effect size (Cohen's D). For the combined data (n = 186), the T-test indicates eight competencies have statistically significant improvement in the mean differences of 7 to 18 percent change in analytical problem solving, futuristic thinking, continuous learning, employee development, presenting, diplomacy, leadership, and written communication. Effect sizes range from 0.13 to 0.38 in which employee development (0.38), diplomacy (0.35), and continuous learning (0.25) have the largest changes.

A comparison of the pre- and post-scores for paired female data indicate that overall female self-efficacy showed a general increase for 18 of 23 competencies. Statistically significant increases in female-student confidence in their abilities occurred in continuous learning, employee development, presenting, diplomacy, and written communication. Percent change increases range from 9.3 to 19.7%. Empathy had a marginally significant improvement of 9.7 percent. A comparison of pre- and post-scores for paired pre-post male data indicate that overall male self-efficacy for 19 of 23 competencies increased. Statistically significant increases in male student confidence in their abilities occurred in employee development/coaching and diplomacy for which mean scores increased by 16.7 and 16.3 percent, respectively. Marginal statistical improvements at the $p < 0.10$ level were noted for continuous learning (7.4% increase), presenting (16.5%), leadership (17.5%), and conflict management (10.5%). Two competencies, management and negotiation decreased by 5 and 7%, respectively, but these were not at a statistically significant level.

DISCUSSION

There have been many reviews regarding the use of effect sizes (Coe 2002, Kortlik and Willams 2003, Fritz et al, 2012, Lipsey et al. 2012; Kraft 2020). Fixed benchmarks have been presented by numerous scholars to characterize the effectiveness of an intervention. Cohen's classic work (Cohen 1969) proposed the following effect size benchmarks of 0.2 for small effect, 0.5 medium effect, and 0.8 large effect, which are commonly cited. Educational researchers have indicated that effect sizes around 0.20 are of policy interest when they are based on measures of academic achievement (Hedges & Hedberg, 2007). Kraft (2020) suggested effect size benchmarks for causal studies related to pre-K–12 education interventions of less than 0.05 are small, 0.05 to < 0.20 are medium, and > 0.20 are large.

Kraft's work among others, endorse the approach that the impact of an intervention should be compared to other studies having broadly comparable contexts. One with which to compare our data are upper level high school students. Lipsey et al (2012) showed effect size gains of less than 0.06 standard deviations on nationally normed standardized achievement tests for reading, math, science and social studies between the spring of eleventh-grade and the spring of twelfth-grade. In a meta-analysis of 40 effect sizes from 31 empirical studies, Niu et al. (2013) reported that the overall effect of instructional interventions on undergraduate college students' critical thinking skills yielded a general effect size of 0.21, with p-values less than 0.01. Niu et al. (2013) argue that what they refer to as small changes in their study are to be expected because improvements in thinking abilities are the result of cognitive growth which is a gradual and cumulative process that can be fostered over time. Considering that professional competencies, unlike some subject-based content knowledge, are developed over typically developed by learning, practice, and cognitive engagement over time, the so-called small effect changes relative to Cohen's class work are likely to be the rule rather than the exception. Depending on the context in terms of relative costs and benefits, an effect size of 0.1 could be a very significant improvement. In this study, an effect size of 0.1 represents an approximate change of 5 to 6 percent. From this point forward, the discussion will focus on gender differences and longitudinal changes in self–efficacy using a cutoff effect size of 0.1.

Self-efficacy for male and female students: A comparison of the average post-program scores for males and females (Table 5) to unpublished average workforce competency levels calculated from TTI archives for September 2013 to May 2019 – N (Male) = 76,404 and N (Female) = 60,460 – indicates that the average student scores for each of the 23 professional competencies are lower the average workforce mean (Figure 1a and b, Gosselin et al. 2013). This is not surprising because competency levels are not fixed and develop through practice. It is unrealistic to expect college-level students who have a limited amount of experience to be at or exceed a work force level of competency development. All these students are in the early phases of their careers and will have many opportunities to acquire these competencies.

Self-efficacy differences are expected to exist between males and females because there are general differences in the development of self-efficacy and related self-beliefs between men and women (Bandura, 1997; Eagly et al 2000). Huang (2013) conducted a meta-analysis of 187 studies containing 247 independent studies that examined gender differences in academic self-efficacy identified an overall effect size of 0.08 favoring males. However, an examination of general self-efficacy differences in studies of males and females for age groups 19-22 and older than 23, reported average effect sizes of 0.12 and 0.23, respectively.

Table 5 documents self-efficacy differences between males and female students as they enter environmental studies consistent with Huang's (2013) observations; However, there is significant complexity in the self- efficacy differences among students. Females have statistically higher self-efficacy related to their abilities to use systematic orderly procedures to meet objectives (planning and organizing); support the professional growth of others (employee development/coaching); utilize tact to handle difficult or sensitive issues in the context of the culture, climate, and politics of the organization (diplomacy); anticipate others wants, needs, and expectations (customer service); and identify with and care about others (empathy). These results are

consistent with Papyrina et al. (2020) who indicated that female business students reported higher self-efficacy than male students with respect to organizational ability,

Effect sizes between 0.26 and 0.42 standard deviations indicate strong differences between women and men. Males, on the other hand, are more confident than women in their abilities to effectively make decisions (decision making); demonstrate initiative, resiliency and a willingness to take responsibility for personal actions (personal effectiveness); achieve results through effective management of available resources (management); facilitate agreements between people (negotiation); and convince others to change the way they think, believe or behave (persuasion). Effect sizes between 0.48 and 0.57 standard deviations indicate even stronger differences between men and women for these characteristics.

The differences between the genders as students enter the program are consistent with social role theory that posits that gender traits are developed as a result of the differential roles that women and men occupy in society that originated out of biological differences (Eagly et al. 2000, Wood and Eagly 2012; Schneider and Bos 2019). An outcome of the development of these differential roles are gender-typical stereotypes. For example, results from Koenig (2018) replicated previous research on gender stereotypes concluding that women are communal and should avoid being dominant. Men should be agentic, independent, masculine in appearance, and avoid being weak, emotional, shy, and feminine in appearance. The characteristics of the five competencies for which the females have higher scores are consistent with communal traits that are typically community oriented and focused on bringing groups together. Communal traits are orientated towards participation of the individual as part of an organization (Abele 2014). The competencies for which males have higher scores are agentic traits. These traits are oriented towards independence focused on the success of the individual (Abele 2014).

The observed statistical differences between males and females related to these agentic and communal traits along with the associated effect size generally are maintained between pre- and post-program data for the unpaired data. However, females overall have higher self-efficacy in self-management ($p<0.05$, effect size = 0.31) and written communication ($p<0.05$, effect size = 0.31) post-program than males. On the other hand, males have higher self-efficacy in their abilities to persuade (($p<0.05$, effect size = 0.33) and manage conflict (($p<0.05$, effect size = 0.37) after completing the program. These differences suggest that the impact of the educational experiences for male and female students is different. Differences in the impact of educational experiences is further supported by an examination of the adjusted effect sizes. If the impact of the educational experience on the males and females were similar, the adjusted effect sizes would be around zero. Of the 23 competencies assessed, eight have adjusted effect sizes greater than plus or minus 0.2. For those having negative adjusted effect values (self-management, customer service, interpersonal skills, conflict management), the values reflect a positive increase in average self-efficacy scores (0.3 to 0.8) for males relative to change in pre- and post-scores for females of +/- 0.1. Interestingly, for the competencies that have adjusted effect sizes that are positive 0.2 or more, male scores drop and the female scores have a marginal increase of 0.1.

The overall impact of and differences between educational experiences are further illustrated by the pre- and post-matched pair data (Table 6). Self-efficacy related to continuous learning, presenting, employee/coaching, and diplomacy show statistically improvement collectively as well as for both males and females having overall effect sizes of 0.1, 0.19, 0.38, and 0.35, respectively. Collectively, as a group (n=186) self-efficacy related to interpersonal skills, analytical problem solving, and futuristic thinking statistically increased ($p<0.5$, effect size = 0.11 to 0.17) and teamwork marginally increased ($p < 0.10$). Collectively, self-efficacy for written communication and leadership significantly increased and empathy marginally increased. These differences were driven by more positive changes in female self-efficacy for written communication (effect size = 0.28) and empathy (effect size = 0.18). Positive change in male self-efficacy (effect size = 0.23) drove the leadership increase.

These data presented document differences between and growth in self efficacy between male and female students in an environmental studies program. Although some of our results regarding self-efficacy are similar to those presented by Papyrina et al. (2020) for business students, some are different as well. The source of actual differences between students, of course, result from factors associated with the characteristics of the students as well as factors and context associated with their academic and sociocultural experience (Petersen and Hyde 2014). Gender interacts with many other identities including race, culture, religion, (dis)ability, ethnicity among others. These data clearly indicate that the two genders bring in different levels of self-efficacy into their undergraduate experience. These levels are related to differences in their social cognitive development (Bandura 1996) as well as the gender stereotypes and gender socialization that society superimposes on them (Eagly 2000, Wood and Eagly 2012; Petersen and Hyde 2014).

The impact of the undergraduate educational experience may exacerbate the differences between genders and not necessarily reduce the differences. Differences are not necessarily a bad thing; however, if one is concerned about the development of gender equity it is important to consider the extent to which undergraduate curriculum is helping all students develop the competencies

and soft skills necessary to be successful in their future careers or is the educational experience contributing to the development of gender-stereotypes and implicit biases amongst its students without knowing it.

Application to Program Learning Outcomes: Goal 1 and learning outcomes 7 and 8 among others were specifically included in the program's learning goals and outcomes to recognize that while technical skills are important attributes a part of excellent educational curricula, success in the workforce requires university curricula to promote the development of professional competencies and soft skills. The importance of the development of "soft skills" and "professional competencies" to the future success of the environmental students is emphasized throughout the program whether they go to graduate school (10 to 15%) school or pursue other career pathway (85 to 90%). The lack of soft skills can sink the promising career of someone who has technical ability and professional expertise (Robles 2012). In Robles (2012), he refers to a study by Klaus (2010) that found 75% of long-term job success depends on people skills (i.e. soft skills), while only 25% is dependent on technical knowledge. Another study cited in John (2009) indicated that hard skills contribute only 15% to one's success, whereas 85% of success is due to soft skills. Our approach adds to the ongoing conversation in higher education regarding matching skills being taught to the skills required for their long-term success.

Following the "you cannot improve what you cannot measure" philosophy, our first-order proxy for the assessment of relevant professional competencies using pre- and post-program scores indicates that our students have grown during their time in the program. Examining changes in self-efficacy over time using the same instrument provides a mechanism to examine relative change over time. It is important to emphasize that no claim is being made that the actual level to which a student has obtained a specific competency is being measured. The basic premise is that the higher a person's self-efficacy, the greater likelihood that the student has or could obtain the competency. Self-efficacy plays a major part in determining the extent to which a student will be successful in obtaining a level of competency to be relevant in the workforce.

As a result of the educational program during their time at UNL, the self-efficacy of both male and female students has increased. The overall scores fall below the employer normative data, but this is to be expected considering that these students are very early in their careers and have time to grow. Relatively high scores for continuous learning are a foundation for optimism in that future environmental challenges, many of which we do not even know about, will require the willingness to undertake additional learning. The very low scores for decision-making and negotiation may reflect the lack of opportunities for decision making prior to and during their academic career. Futuristic thinking is a key competency for sustainability professionals (Weik et al. 2015) so the low scores for this competency are troublesome. It is clear that there is a need to create more opportunities to practice the skills of futuristic thinking, decision-making, and negotiation. Our data supports the contention that development of 21st century competencies is occurring as the student actively engages in activities where they can practice these skills.

LIMITATIONS

There are numerous limitations related to the instrument being a self-assessment (Bedwell 2011, Gosselin et al. 2013); However, when examining changes in self-efficacy over time using the same instrument, the goal is to examine relative change between pre- and post-scores. The comparison of pre- and post-program data is to document the extent to which the students have grown during their time in the program.

Another limitation is the lack of a control group to which to compare at UNL to assess the extent to which the Environmental Studies program has contributed to the changes in self-efficacy versus the contribution of their overall undergraduate experience both the formal and informal components. A related limitation is the variability superimposed on the data related to the duration of time the student has been in the program from when they enter to when they graduate. Some students may enter the program as a junior others enter as a new first year freshmen. Currently, a distinction cannot be made regarding the treatment that the students experience from the environmental studies program.

Although there are limitations, these are outweighed by the benefits to the program and instructors. These include: a better understanding of how information may best be delivered to students; explanation of the motivations behind student choices; and a framework that helps opens lines of communication in social settings, classroom interactions, work and even at home (Gosselin et al. 2013). The comparison of pre- and post-program data can be used to document the extent to which the students have grown throughout the program in the context of meeting future accountability criteria for higher education.

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Table 3. Definitions of the 23 competencies assessed using the TTI TriMetrix® DNA system and categorized using the domains identified by the National Research Council. (NRC, 2012; Gosselin et al. 2013)

Competency Domains (NRC, 2012)	TTI DNA Competencies and Definitions of the 23 Professional/Personal Soft Skill Competencies
Cognitive Competencies: n = 5	***Planning and Organizing*** - Using logical, systematic and orderly procedures to meet objectives. ***Analytical Problem Solving*** - Anticipating, analyzing, diagnosing, and resolving problems. ***Decision Making*** - Utilizing effective processes to make decisions. ***Creativity/Innovation*** - Adapting traditional or developing new approaches, concepts, methods, models, designs, processes, technologies and/or systems. ***Futuristic Thinking*** - Imagining, envisioning, projecting and/or predicting what has not yet been realized.
Intrapersonal Competencies: n = 5	***Continuous Learning*** - Taking initiative in learning and implementing new concepts, technologies, and/or methods. ***Goal Orientation*** - Energetically focusing efforts on meeting a goal, mission or objective. ***Self- Management*** - Demonstrating self control and an ability to manage time and priorities. ***Flexibility*** - Agility in adapting to change. ***Personal Effectiveness*** - Demonstrating initiative, self-confidence, resiliency and a willingness to take responsibility for personal actions.
Interpersonal Competencies: n = 13	***Employee Development/Coaching*** - Facilitating and supporting the professional growth of others. ***Presenting*** - Communicating effectively to groups. ***Diplomacy*** - Effectively handling difficult or sensitive issues by utilizing tact, diplomacy and an understanding of organizational culture, climate and/or politics. ***Management*** - Achieving extraordinary results through effective management of resources, systems and processes. ***Customer Service*** - Anticipating meeting and/or exceeding customer needs, wants and expectations. ***Interpersonal Skills*** - Effectively communicating, building rapport and relating well to all kinds of people. ***Leadership*** - Achieving extraordinary business results through people. ***Teamwork*** - Working effectively and productively with others. ***Conflict Management*** - Addressing and resolving conflict constructively. ***Empathy*** - Identifying with and caring about others ***Persuasion*** - Convincing others to change the way they think, believe or behave. ***Written Communication*** - Writing clearly, succinctly and understandably. ***Negotiation*** - Facilitating agreements between two or more parties.

Table 5a provides the mean scores from males and females, mean difference, Wilcoxon Ranks Sum variables, Welch's T-test p-values and effect size (Cohen's D) for the unpaired pre-program data.

		Unmatched Pre Male vs Female Statistics												
NRC Domains	**TTI Performance DNA Competencies**	**Male N**	**Male mean**	**Male SD**	**Female N**	**Female mean**	**Female SD**	**Mean Difference F -M**	**U**	**Z**	**p-value**	**Effect Size Z/**	**T-test Unpaired p- value**	**Effect Size Cohen's D**
Cognitive Competencies: n=5	Planning and Organizing	97	4.3	2.1	132	5.0	2.3	0.7	5299	-2.230	0.026	0.15	0.023	0.30
	Analytical Problem Solving	97	4.0	1.8	132	4.1	1.8	0.1	6081	-0.649	0.517	0.04	0.656	0.06
	Decision Making	97	2.6	2.1	132	1.6	1.9	-1.0	4509	3.868	0.000	0.26	0.000	-0.52
	Creativity/Innovation	97	4.0	2.5	132	4.0	2.2	0.0	6473	0.060	0.953	0.00	0.894	-0.02
	Futuristic Thinking	97	2.5	2.3	132	2.0	1.9	-0.5	5722	1.387	0.166	0.09	0.092	-0.23
Intrapersonal Competencies: n = 5	Continuous Learning	97	6.2	2.1	132	6.3	2.2	0.1	6191	-0.426	0.671	0.03	0.758	0.04
	Goal Orientation	97	5.6	2.0	132	5.7	2.2	0.1	6116	-0.578	0.564	0.04	0.654	0.06
	Self- Management	97	3.9	2.5	132	3.7	2.9	-0.2	6105	0.602	0.548	0.04	0.606	-0.07
	Flexibility	97	3.7	2.4	132	3.7	2.4	-0.1	6347	0.112	0.912	0.01	0.868	-0.02
	Personal Effectiveness	97	5.2	2.1	132	4.1	1.9	-1.1	4310	4.229	0.000	0.28	0.000	-0.57
Interpersonal Competencies: n=13	Employee Development/Coaching	97	4.6	2.1	132	5.1	2.0	0.5	5230	-2.371	0.018	0.16	0.053	0.26
	Presenting	97	3.3	2.8	132	3.2	2.9	-0.2	6042	0.730	0.466	0.05	0.622	-0.07
	Diplomacy	97	4.2	2.0	132	4.8	2.6	0.6	5379	-2.067	0.039	0.14	0.059	0.25
	Management	97	5.4	1.5	132	4.7	1.5	-0.7	4812	3.218	0.001	0.21	0.001	-0.48
	Customer Service	97	4.6	1.9	132	5.1	2.1	0.5	5373	-2.082	0.038	0.14	0.046	0.27
	Interpersonal Skills	97	4.9	3.2	132	5.0	3.4	0.1	6224	-0.360	0.720	0.02	0.759	0.04
	Leadership	97	3.8	2.8	132	4.0	2.6	0.2	6034	-0.744	0.457	0.05	0.494	0.09
	Teamwork	97	5.5	1.9	132	5.2	2.1	-0.3	5850	1.115	0.265	0.07	0.273	-0.15
	Conflict Management	97	4.2	2.1	132	4.1	1.9	-0.1	6261	0.285	0.776	0.02	0.588	-0.07
	Empathy	97	3.9	2.7	132	5.0	2.7	1.1	4926	-2.983	0.003	0.20	0.002	0.41
	Persuasion	97	4.1	2.7	132	3.5	2.6	-0.6	5540	1.743	0.082	0.12	0.087	-0.23
	Written Communication	97	4.0	2.6	132	4.6	3.0	0.6	5703	-1.412	0.158	0.09	0.105	0.21
	Negotiation	97	3.0	2.6	132	2.0	1.9	-1.0	4986	2.882	0.004	0.19	0.001	-0.47

Table 5b provides the mean scores from males and females, mean difference, Wilcoxon Ranks Sum variables, Welch's T-test p-values and effect size (Cohen's D) for the unpaired post-program data.

		Unmatched Post Male vs Female Statistics													
NRC Domains	**TTI Performance DNA Competencies**	**Male N**	**Male mean**	**Male SD**	**Female N**	**Female mean**	**Female SD**	**Mean Difference F-M**	**U**	**Z**	**p-value**	**Effect Size Z/**	**T-test Unpaired P-Value**	**Effect Size Cohen's D**	**Adjusted Effect Size Post - Pre Cohen's D**
Cognitive Competencies: n=5	Planning and Organizing	103	4.3	2.2	124	5.1	2.4	0.8	5248	-2.314	0.021	0.15	0.013	0.33	0.03
	Analytical Problem Solving	103	4.4	1.7	124	4.3	1.8	-0.1	6236	0.305	0.761	0.02	0.773	-0.04	-0.10
	Decision Making	103	2.7	2.3	124	1.6	1.9	-1.1	4438	4.004	0.000	0.27	0.000	-0.53	-0.02
	Creativity/Innovation	103	3.7	2.5	124	4.1	2.4	0.4	5795	-1.202	0.230	0.08	0.169	0.18	0.20
	Futuristic Thinking	103	2.7	2.1	124	2.3	1.9	-0.3	5892	1.008	0.314	0.07	0.236	-0.16	0.08
Intrapersonal Competencies: n = 5	Continuous Learning	103	6.9	2.1	124	6.7	2.0	-0.1	5991	0.804	0.422	0.05	0.670	-0.06	-0.10
	Goal Orientation	103	5.5	2.1	124	5.9	2.3	0.4	5446	-1.708	0.088	0.11	0.150	0.19	0.13
	Self- Management	103	4.5	2.8	124	3.6	2.8	-0.9	5261	2.290	0.022	0.15	0.023	-0.31	-0.24
	Flexibility	103	4.0	2.4	124	3.7	2.3	-0.3	5841	1.108	0.268	0.07	0.313	-0.14	-0.11
	Personal Effectiveness	103	5.0	2.2	124	4.2	2.1	-0.8	4934	2.952	0.003	0.20	0.005	-0.38	0.20
Interpersonal Competencies: n=13	Employee Development/Coaching	103	5.5	2.0	124	5.9	2.2	0.4	5407	-1.992	0.047	0.13	0.118	0.21	-0.05
	Presenting	103	4.0	3.1	124	3.5	3.0	-0.5	5742	1.310	0.190	0.09	0.214	-0.17	-0.10
	Diplomacy	103	5.0	2.2	124	5.5	2.0	0.6	5325	-2.158	0.031	0.14	0.048	0.27	0.02
	Management	103	5.2	1.5	124	4.8	1.6	-0.4	5472	1.861	0.063	0.12	0.051	-0.26	0.21
	Customer Service	103	4.9	2.1	124	5.0	2.2	0.1	6253	-0.270	0.788	0.02	0.677	0.06	-0.21
	Interpersonal Skills	103	5.7	3.1	124	5.1	3.3	-0.6	5740	1.313	0.189	0.09	0.181	-0.18	-0.22
	Leadership	103	4.5	2.9	124	4.4	3.0	-0.1	6310	0.156	0.877	0.01	0.850	-0.03	-0.12
	Teamwork	103	5.8	1.4	124	5.6	2.2	-0.2	6111	0.559	0.577	0.04	0.424	-0.11	0.04
	Conflict Management	103	4.9	2.1	124	4.1	2.0	-0.7	4990	2.839	0.005	0.19	0.007	-0.37	-0.29
	Empathy	103	4.1	2.4	124	5.3	2.5	1.2	4719	-3.387	0.001	0.22	0.001	0.47	0.06
	Persuasion	103	4.3	2.8	124	3.4	2.8	-0.9	5151	2.513	0.012	0.17	0.015	-0.33	-0.10
	Written Communication	103	4.3	2.6	124	5.2	2.5	0.9	5021	-2.773	0.006	0.18	0.007	0.36	0.15
	Negotiation	103	2.9	2.5	124	1.8	2.2	-1.1	4505	3.867	0.000	0.26	0.000	-0.49	-0.01

Table 6a provides paired pre- and post-data for all male and female combined (n = 186).

		Matched Pairs - Males and Female Data Pre versus Post										
		All Data Pre vs Post Paired N = 186										
NRC Domains	**TTI Performance DNA Competencies**	**Pre mean**	**Pre SD**	**Post mean**	**Post SD**	**Mean Difference Post - Pre**	**W**	**Z**	**p-value**	**Effect Size Z/**	**T-test Paired p-value**	**Effect Size Cohen's D**
Cognitive Competencies: n=5	Planning and Organizing	4.6	2.2	4.8	2.4	0.2	6400	-1.229	0.110	0.09	0.229	0.10
	Analytical Problem Solving	4.1	1.8	4.4	1.8	0.3	6422	-1.905	0.028	0.14	0.047	0.17
	Decision Making	2.0	2.0	2.0	2.1	-0.1	5659	-0.286	0.387	0.02	0.771	-0.03
	Creativity/Innovation	3.9	2.3	4.0	2.5	0.1	7404	-0.441	0.330	0.03	0.581	0.05
	Futuristic Thinking	2.2	2.1	2.5	2.1	0.3	5761	-1.649	0.050	0.12	0.050	0.16
Intrapersonal Competencies: n = 5	Continuous Learning	6.2	2.2	6.8	2.1	0.5	6143	-2.321	0.010	0.17	0.006	0.25
	Goal Orientation	5.5	2.1	5.6	2.2	0.1	7198	-0.749	0.227	0.05	0.538	0.05
	Self- Management	3.9	2.7	3.9	2.9	0.0	7039	-0.225	0.411	0.02	0.921	0.01
	Flexibility	3.7	2.4	3.7	2.4	0.0	7006	-0.147	0.442	0.01	0.982	0.00
	Personal Effectiveness	4.6	2.1	4.6	2.2	-0.1	7648	-0.587	0.279	0.04	0.627	-0.04
Interpersonal Competencies: n=13	Employee Development/Coaching	4.9	2.1	5.7	2.2	0.8	4403	-4.459	0.000	0.33	0.000	0.38
	Presenting	3.2	2.9	3.8	3.0	0.6	5286	-2.541	0.006	0.19	0.005	0.19
	Diplomacy	4.5	2.4	5.3	2.2	0.8	5494	-3.592	0.000	0.26	0.000	0.35
	Management	5.0	1.5	5.0	1.6	0.0	7329	-0.038	0.485	0.00	0.941	-0.01
	Customer Service	5.0	2.1	4.9	2.2	-0.2	6879	-0.857	0.196	0.06	0.390	-0.07
	Interpersonal Skills	4.9	3.4	5.2	3.2	0.4	5744	-1.797	0.036	0.13	0.155	0.11
	Leadership	3.9	2.8	4.4	3.1	0.5	5852	-2.203	0.014	0.16	0.022	0.18
	Teamwork	5.3	2.0	5.6	1.9	0.3	6742	-1.546	0.061	0.11	0.116	0.14
	Conflict Management	4.2	2.0	4.5	2.1	0.2	6751	-1.052	0.146	0.08	0.172	0.12
	Empathy	4.5	2.7	4.8	2.5	0.4	6705	-1.364	0.086	0.10	0.111	0.14
	Persuasion	3.9	2.7	3.8	2.8	0.0	7157	-0.040	0.484	0.00	0.857	-0.01
	Written Communication	4.3	2.9	4.8	2.6	0.5	6001	-2.533	0.006	0.19	0.028	0.18
	Negotiation	2.5	2.4	2.3	2.4	-0.2	5965	-1.066	0.143	0.08	0.395	-0.07

Table 6b provides paired pre- and post-data for females only (n = 107).

		Matched Pairs - Female Data - Pre-Post										
		Females Pre vs Post Paired n = 107										
NRC Domains	**TTI Performance DNA Competencies**	**Pre mean**	**Pre SD**	**Post mean**	**Post SD**	**Mean Difference Post - Pre**	**W**	**Z**	**p-value**	**Effect Size Z/**	**T-test Paired p-value**	**Effect Size Cohen's D**
Cognitive Competencies: n=5	Planning and Organizing	4.9	2.3	5.1	2.5	0.3	2161	-1.096	0.273	0.11	0.280	0.11
	Analytical Problem Solving	4.1	1.8	4.4	1.8	0.3	2217	-1.215	0.224	0.12	0.204	0.14
	Decision Making	1.6	1.9	1.5	1.9	-0.1	1582	-0.185	0.854	0.02	0.634	-0.05
	Creativity/Innovation	3.9	2.2	4.1	2.5	0.2	2295	-0.793	0.428	0.08	0.367	0.10
	Futuristic Thinking	2.0	1.9	2.3	1.9	0.3	1909	-1.379	0.168	0.13	0.108	0.18
Intrapersonal Competencies: n = 5	Continuous Learning	6.2	2.3	6.8	2.0	0.6	2034	-1.836	0.066	0.18	0.044	0.27
	Goal Orientation	5.5	2.3	5.7	2.3	0.2	2367	-0.707	0.480	0.07	0.417	0.08
	Self- Management	3.9	2.9	3.6	2.9	-0.3	2076	-0.921	0.357	0.09	0.301	-0.11
	Flexibility	3.8	2.5	3.6	2.4	-0.2	2125	-0.744	0.457	0.07	0.493	-0.07
	Personal Effectiveness	4.2	1.9	4.2	2.2	0.0	2610	-0.055	0.956	0.01	0.996	0.00
Interpersonal Competencies: n=13	Employee Development/Coaching	5.1	2.0	5.9	2.2	0.8	1454	-3.444	ok	0.33	0.001	0.40
	Presenting	2.9	2.9	3.4	2.9	0.6	1704	-1.696	0.090	0.16	0.051	0.19
	Diplomacy	4.6	2.6	5.5	2.1	0.9	1763	-3.013	0.003	0.29	0.002	0.38
	Management	4.7	1.5	4.9	1.6	0.2	2019	-1.288	0.198	0.12	0.209	0.13
	Customer Service	5.3	2.2	4.9	2.2	-0.3	2048	-1.024	0.306	0.10	0.172	-0.15
	Interpersonal Skills	4.9	3.6	5.1	3.3	0.2	2115	-0.613	0.540	0.06	0.535	0.06
	Leadership	3.9	2.7	4.3	3.1	0.4	2310	-1.057	0.291	0.10	0.187	0.13
	Teamwork	5.2	2.1	5.5	2.2	0.3	2235	-1.307	0.191	0.13	0.170	0.15
	Conflict Management	4.1	2.0	4.2	2.1	0.1	2577	-0.167	0.867	0.02	0.698	0.04
	Empathy	4.8	2.8	5.3	2.4	0.5	2106	-1.593	0.111	0.15	0.100	0.18
	Persuasion	3.5	2.6	3.4	2.9	0.0	2322	-0.022	0.983	0.00	0.856	-0.02
	Written Communication	4.3	3.0	5.1	2.5	0.8	1798	-2.365	0.018	0.23	0.019	0.28
	Negotiation	1.9	1.9	1.8	2.2	-0.1	2023	-0.625	0.532	0.06	0.672	-0.05

Table 6c provides paired pre- and post-data for and males only (n = 79).

		Matched Pairs - Male Data - Pre-Post										
		Males Pre vs Post Paired n = 79										
NRC Domains	**TTI Performance DNA Competencies**	**Pre mean**	**Pre SD**	**Post mean**	**Post SD**	**Mean Difference Post - Pre**	**W**	**Z**	**p-value**	**Effect Size Z/**	**T-test Paired p-value**	**Effect Size Cohens D**
Cognitive Competencies: n=5	Planning and Organizing	4.2	2.2	4.3	2.1	0.2	1145	-0.571	0.568	0.06	0.535	0.08
	Analytical Problem Solving	4.0	1.9	4.4	1.8	0.4	1105	-1.855	0.064	0.21	0.134	0.20
	Decision Making	2.5	2.0	2.5	2.2	0.0	1170	-0.018	0.985	0.00	0.964	0.01
	Creativity/Innovation	3.9	2.6	3.9	2.5	-0.1	1339	-0.261	0.794	0.03	0.876	-0.02
	Futuristic Thinking	2.5	2.3	2.8	2.2	0.3	1058	-1.083	0.279	0.12	0.270	0.15
Intrapersonal Competencies: n = 5	Continuous Learning	6.3	2.1	6.8	2.2	0.5	1037	-1.724	0.085	0.19	0.077	0.22
	Goal Orientation	5.5	1.9	5.5	2.1	0.0	1201	-0.635	0.526	0.07	0.966	0.01
	Self- Management	3.8	2.5	4.3	2.8	0.5	1106	-1.345	0.179	0.15	0.153	0.19
	Flexibility	3.7	2.4	3.9	2.4	0.2	1169	-0.625	0.532	0.07	0.475	0.09
	Personal Effectiveness	5.2	2.1	5.0	2.2	-0.2	1189	-1.250	0.211	0.14	0.425	-0.09
Interpersonal Competencies: n=13	Employee Development/Coaching	4.7	2.2	5.5	2.1	0.8	812	-2.961	0.003	0.33	0.005	0.37
	Presenting	3.6	2.9	4.2	3.1	0.6	968	-1.779	0.075	0.20	0.086	0.20
	Diplomacy	4.3	2.1	5.0	2.3	0.7	976	-2.063	0.039	0.23	0.023	0.31
	Management	5.5	1.4	5.2	1.5	-0.3	1060	-1.427	0.154	0.16	0.089	-0.20
	Customer Service	4.7	2.0	4.8	2.1	0.1	1425	-0.389	0.698	0.04	0.734	0.04
	Interpersonal Skills	4.8	3.3	5.4	3.1	0.6	973	-1.752	0.080	0.20	0.145	0.18
	Leadership	3.9	2.8	4.6	3.0	0.7	957	-1.498	0.134	0.17	0.055	0.23
	Teamwork	5.5	1.9	5.7	1.5	0.2	1247	-0.757	0.449	0.09	0.424	0.12
	Conflict Management	4.4	2.0	4.9	2.2	0.5	1006	-1.733	0.083	0.19	0.092	0.22
	Empathy	4.1	2.6	4.3	2.5	0.2	1336	-0.278	0.781	0.03	0.537	0.08
	Persuasion	4.4	2.7	4.4	2.7	0.0	1380	-0.043	0.966	0.00	0.960	-0.01
	Written Communication	4.2	2.8	4.3	2.6	0.1	1413	-0.063	0.950	0.01	0.657	0.05
	Negotiation	3.3	2.7	3.0	2.5	-0.2	1098	-1.035	0.301	0.12	0.425	-0.10

Figure 1a (Female). A comparison of the average post-program scores for males and females (Table 5) to unpublished average workforce competency levels calculated from TTI archives for September 2013 to May 2019 – N (Male) = 76,404 and N (Female) = 60,460 – indicates that the average student scores for each of the 23 professional competencies are lower the average workforce mean.

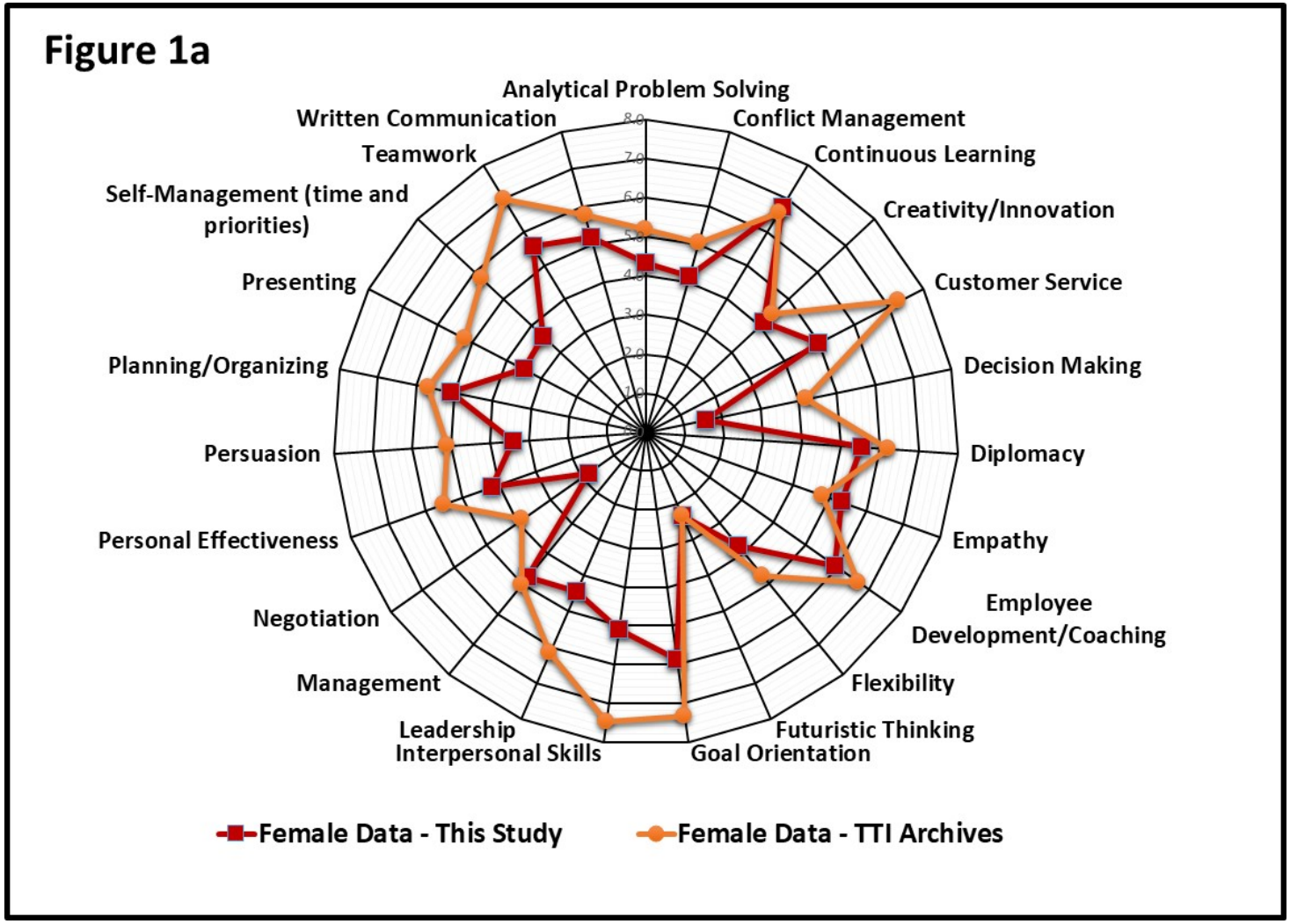

Figure 1b (Male). A comparison of the average post-program scores for males and females (Table 5) to unpublished average workforce competency levels calculated from TTI archives for September 2013 to May 2019 – N (Male) = 76,404 and N (Female) = 60,460 – indicates that the average student scores for each of the 23 professional competencies are lower the average workforce mean.