

## Evaluating Self-Assessed and CWI Welding Scores by Gender

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### Introduction

Female agricultural sciences undergraduate students have slowly increased to become the majority of graduates over the past decade (NCES, 2019). Due to this trend, there has been an increased number of females enrolled agricultural mechanics courses. Parr et al. (2008) recognized a need to teach technical and cognitive skills in agricultural mechanics courses. Technical skills in agricultural mechanics may include, but not limited to agricultural power, structures, welding fabrication and electrical systems. However, men have been shown to overestimate their performance prior to completing a task in comparison with women who underestimated their performance beforehand (Reuben et al., 2014). Lichtenstein et al. (1982) found men to be more overconfident in their success in uncertain situations and their relative performance in a task (solving mathematical problems) than women. In a recent study performed, undergraduate physics students were asked to evaluate their self-efficacy related to this course (Marshman et al., 2018). This study noticed that self-efficacy towards course success was derived more from students' perceptions rather than actual performance (Marshman et al., 2018). Additionally, this study continued to confirm that females had a weaker self-efficacy than their male counterparts.

### Theoretical Framework

Self-Efficacy Theory in education has served as the theoretical framework for this study. This theory focuses on perceiving one's capabilities, performance, and new skills at different levels. Self-efficacy is known to be influenced by the behaviors of the environment, goal achievements, feedback from instructors, and comparison among their peers by their performance (Schunk & Usher, 2012). Negative and positive feedback can affect self-efficacy but will not change the interpretation of one's capabilities (Schunk & Usher, 2012). To achieve adequate skills and attain a positive learning experience, self-efficacy is the key to motivate, self-evaluate, and achieve their goals in a task or situation (Schunk & Usher, 2012). Multiple behaviors can influence the increase or decrease of one's self-efficacy, affecting how one perceives their capabilities.

### Purpose and Objectives

The purpose of this study is to evaluate the self-assessment of students welding scores by gender. This study aligns with the American Association for Agricultural Education National Research Agenda Research Priority Area 4: Meaningful, Engaged Learning in All Environments. Providing a meaningful and engaging learning experience to beginner welders by practicing self-evaluation and developing welding skills. Allowing students to be self-confident, communicate effectively, and develop creative solutions to complex problems (Robert et al., 2016). The objectives for this study are as follows:

1. Determine if a difference exists between female and male scores on self-assessments of their welding performance.
2. Determine if a discrepancy exists between the self-assessment and certified welding inspector (CWI) welding scores for both females and males.

### Methods

Participants ( $n = 42$ ) were allowed one-hour-and-fifty-minute lab period in the Introduction to Agricultural Engineering course to practice welding. Prior to the final lab, participants received training protocol and demonstration using the VRTEX 360 and REALWELD. Participants completed three rounds on the VRTEX 360, each round consisting of four practice weld passes, using a different visual cue for each pass, and one with no visual cues. For the REALWELD, students completed four rounds using audial cues in the arc-off mode and three rounds, using audial cues in the arc-on mode. For the final lab, participants used a ¼" mild steel in the 2F position to complete as many welds as possible during the session which their best weld was submitted for grading. A grading criterion developed by Herren (2009) was used by the students and an American Welding Society (AWS) accredited CWI to score the weld submitted.

### Results

This study collected data from 42 participants, with a majority identifying as female ( $f = 23$ ; 52.3%). Table 1 reports the mean scores between males and females for the self-assessment of their own welds. Males presented a higher self-assessed score of ( $M = 86.32$ ,  $SD = 10.33$ ) compared female scores ( $M = 72.70$ ,  $SD = 18.89$ ). There was a statistically significant ( $p < 0.05$ ) difference between the male and female scores.

*Self-Assessment of Welding Scores by Gender*

Gender	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Male	19	86.32	10.33	2.81	40	0.01
Female	23	72.70	18.89			

Tables 2 reports the mean scores between males and females for both their self-evaluation and CWI. Males presented a higher self-assessed score of ( $M = 86.32$ ) than the welding score evaluated by the CWI of ( $M = 84.68$ ). In comparison, the females evaluated their welds to be lower ( $M = 72.70$ ) than in comparison to the ( $M = 79.00$ ) score assessed by the CWI.

*Welding Scores by Gender as Assessed by Certified Welding Inspector (CWI)*

Gender	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Male	19	84.68	6.47	1.79	40	0.08
Female	23	79.00	12.50			

### Conclusion, Discussion, and Recommendation

Ultimately, males performed better in this study but scored themselves higher than the CWI did. The females did not perform as well as their male counterpart, but they were more critical of their weld performance. This could be the result of machismo, the combination of inferiority feelings and superiority behaviors by avoiding feminine traits and acting on strong masculine ones. In addition, studies show that men are physiologically taught to be superior to women and follow other men due to cultural influences and women rewarding traditional masculine behavior (Ingoldsby, 1985). It is recommended to replicate the study with increased welding evaluation training in class to allow the students to perceive their welds proficiently and attain accurate scores aligned with the CWI.

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